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ABSTRACT

During the National Institute of Education's (NIE) early years of growth, the director and his staff will be making many choices that will determine the NIE's organizational and managerial form and, inseparably, shape its effect on education. The purpose of this Working Note is to present a number of different strategies for the NIE that its managers can use as alternatives in making these choices. In presenting these strategies the authors first discuss some basic elements concerning organizational and managerial design and some of the most attractive combinations of these elements. Each of these combinations is called a strategy for the NIE. To add concreteness, each strategy is used to generate a fully detailed model of management procedure and organization for the NIE. The models are not intended as blueprints for implementation in a sequence of formally outlined steps, but rather as concrete examplars of the alternative strategies proposed for organizing and managing educational R&D. An extensive bibliography is provided. (Author)

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WN-7793-HEW

ALTERNATIVE DESIGNS FOR THE NATIONAL INSTITUTE OF EDUCATION

John Wirt

August 1972

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PREFACE

Planning for the National Institute of Education (NIE) has been underway for over two years. The first stage resulted in the President's *Message on Educational Reform* of March 3, 1970, and the NIE bill introduced in the Congress. Since then, the planning activity has continued and a number of reports on different aspects of the NIE have been prepared. One of the first reports was produced by The Rand Corporation in February 1971 (R-657-HEW, *National Institute of Education: Preliminary Plan for the Proposed Institute*). In Rand's study, both the program of activities that the NIE could undertake and an organizational plan for the Institute were considered. Under the guidance of the NIE Planning Unit that was formed in the Office of Education after the completion of Rand's study, a number of additional studies on selected topics have been undertaken to prepare for the beginning of NIE's operations. This report is the result of one of those studies.

In addition to the Planning Unit's efforts, the Congress has carefully examined whether or not the NIE should be created and, if so, what its responsibilities, methods, and activities should be. The Congress has issued a number of reports resulting from its deliberations.

This report presents three alternative strategies for organizing and managing the NIE during its early years. Two of these strategies are quite different from Rand's preliminary plan for the NIE, and one is very close to that plan. These strategies have been distilled from Rand's research on the practices of federal agencies and industries that support research and development (R&D) and from the research literature on organization and management. The strategies are intended to provide major alternative approaches from which the NIE can choose in organizing and managing R&D and applying it to educational problems in its early years.

Sections I and II of this report present five basic choices that must be made in designing an organizational and managerial strategy for the NIE. The many possible combinations of these choices are reduced to three most attractive sets of choices, or strategies. In Sections III, IV, and V, detailed organizational and managerial plans

for implementing each of the strategies are presented.

There are skeptics who say that preparing generalized designs for an R&D institution is a fruitless endeavor. They argue that the external political environment is so complex and influential that it overwhelms any presumption to consider practical ways of deliberately constructing and operating an organization. Others point out the limited availability of operational theories about the best ways to organize and manage R&D. It is argued that an organization is no more than the people in it, and that once these people are chosen, what they will do is predetermined by their own preferences and the external environment. If true, this view invites a prior question: What kinds of personnel should be chosen and what should their preferences be? Certainly, these considerations should be part of any design for an organization.

We will try to meet the challenge of the skeptics by presenting prima facie evidence--organizational and managerial strategies that are intrinsically different but apparently feasible. We will be concerned with alternative responsibilities that could be assigned to NIE personnel having certain preferences, the managerial activities these personnel could establish, the kinds of R&D activities that could be emphasized, and the relationships of authority between different groups within the organization and between the organization and its environment. We will take what we think is a different approach to presenting organizational and managerial designs.

ACKNOWLEDGMENTS

A major contribution to this report was made by the many R&D managers and others interviewed during the course of our study. Over 100 individuals were interviewed, some on several occasions. Their willingness to grant interviews for discussing R&D management and organization was always generous, and their observations extensive and thoughtful. Without the contributions of all those interviewed, this report would not have been possible.

Responsibility for the contents of this report is entirely ours. Individuals that we interviewed may or may not disagree with our interpretation of their statements or the emphases that we have selected in our presentation.

A special debt is owed to Karen Brown and Jean Grimes of The Rand Corporation staff for assistance in publishing this report. An author is greatly aided when he can give imperfectly worded and tentatively formated draft to professionals capable of transforming it into a finished product. Karen edited the text of this report, and along with Jean, designed and produced the many tables and figures intended to display its contents in a compact form.

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I. INTRODUCTION

During the National Institute of Education's early years of growth, the Director and his staff will be making many choices that will determine the NIE's organizational and managerial form and, inseparably, shape its effect on education. The purpose of this Working Note is to present a number of different strategies for the NIE that its managers can use as alternatives in making these choices.

In presenting these strategies, we will discuss, first, some basic elements concerning organizational and managerial design and, second, some of the most attractive combinations of these elements. Each of these combinations will be called a strategy for the NIE. Third, to add concreteness, each strategy will be used to generate a fully detailed model of management procedure and organization for the NIE. The models are not intended as blueprints for implementation in a sequence of formally outlined steps, but rather as concrete exemplars of the alternative strategies proposed for organizing and managing educational R&D. These strategies would be difficult to convey entirely in the abstract.

R&D OBJECTIVES

Both the Congress and the Executive have addressed the issue of the NIE's objectives, and agreement on this issue has emerged.* In the remainder of this section we will present our interpretation of these objectives and indicate the kinds of activities that the NIE might support under each one.

The order in which the NIE's objectives are presented is not necessarily indicative of their priority for the NIE.

Based on a number of other considerations, which will be discussed shortly, NIE managers might choose to emphasize some of the objectives more than others. A particular emphasis would be achieved

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*Higher Education Act of 1965, Title III, as amended 23 June 1972, Sec. 405.

by adjusting the allocation of the NIE's resources to favor high-priority objectives. Thus, one of the basic design elements in an R&D strategy for the NIE is the relative emphasis given to various objectives.

The NIE's objectives are grouped into two categories: direct objectives to create and implement R&D results, and supporting objectives to improve the NIE's ability to achieve its direct objectives.

Direct Objectives

Objective I: To help solve or alleviate some important national problems of American education in a relatively short period of time.*

There is general agreement that one NIE objective should be to find solutions to specific, nationally important educational problems. Efforts in support of this objective would be distinguished from other NIE efforts to solve practical educational problems by (1) the necessity of making significant progress in a relatively *short period of time* and (2) the criterion of selecting problems of *national importance*. These distinctions would force greater reliance on existing knowledge and capabilities and greater emphasis on solving selected problems than in other NIE activities.

The kinds of activities that could be included under this objective are:

- *Broad-scale attacks on chronic deficiencies* such as unequal access to education or ineffective use of resources.
- *Solutions to priority problems* such as school financing formulas or drug abuse education.
- *Exploitation of research accomplishments* such as a major advance in learning technology.
- *Responses to Office of Education priorities* such as career education models or compensatory reading curriculum.

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*Levien, R. E., *National Institute of Education: Preliminary Plan for the Proposed Institute*, The Rand Corporation, R-657-HEW, February 1971, p. 24.

Objective II: To create improved educational policies and practices through continuing programs of research, development, and evaluation.*

This objective would involve advancing the state of educational practice on a broad front through direct investigation of educational phenomena and invention of educational improvements in many areas. Consideration could be given to both local and national problems and to all age groups. Subjects could include learning, instruction, administration, and measurement. The effort would probably involve a mixture of coordinated and individual projects and a wide range of skills and backgrounds. It would doubtless require the joint participation of professionals in R&D, education, and management, as well as members of the public community.

Some activities that NIE could support under this objective are:

- o *Analyses of current practice* to point the way to promising improvements.
- o *Experiments and demonstrations* to test new educational approaches.
- o Research and development on improved methodology and instruments for *educational measurement*.
- o Inquiry concerning *characteristics of the learning process*--students, teachers, subject matter, and interactions among them.
- o *Development of curriculum* and instructional improvements.
- o Inquiry into *improved decision policies* for parents, practitioners, administrators, and managers.
- o *Evaluations of educational programs and products*.
- o Construction of simulations and other *quantitative models* of education systems.

Objective III: To strengthen the foundations of scientific knowledge on which education rests.**

The NIE's practice-improvement activities would be enhanced in

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*Ibid., p. 29.

**Ibid., p. 33.

precision and quality by improvements in scientific knowledge regarding basic physical, biological, psychological, social, and informational processes. Activities implied by this objective differ from those implied by Objective II principally in the kinds of problems attacked and the method used for achieving results. In building scientific knowledge, the topics of study are ordinarily of a more universal and fundamental nature and less directly related to the solution of practical education problems. Projects are chosen primarily for their intrinsic contribution to improving understanding and, most importantly, for their potential solvability. Emphasis is placed on understanding phenomena and problems that are important to education, but it is not the primary criterion. Nevertheless, scientific advancement often opens frontiers for practice. When these advances occur, they are usually significant enough to affect large segments of the population over long periods of time.

Strengthening the foundations of scientific knowledge includes activities such as:

- Philosophical and historical *inquiry into the goals of education.*
- Experimental and conceptual *inquiry into individual learning and intellectual growth.*
- Experimental and conceptual *inquiry into educational measurement.*
- Experimental *inquiry into the physiology of learning.*
- Experimental and conceptual *inquiry into group interactions* affecting education.
- Experimental and conceptual *inquiry into societal interactions* affecting education.
- *Longitudinal studies* of educational phenomena and maintenance of *carrier populations* for experiment.*

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*J. Gallagher and J. Sparling (eds.), *Research Directions for the '70s for Child Development*, Frank Porter Graham Child Development Center, University of North Carolina, Chapel Hill, 1972, pp. 15-17.

Objective IV: To link R&D with all components of educational policymaking and practice.

A chronic problem in educational R&D has been a failure to link R&D with educational policy and practice. The purposes of linking R&D with educational policymaking and practice are to aid in directing R&D toward actual needs and foster widespread use of R&D results in educational practice. This can involve a large number of activities, including the following:

- o *Operation of a network of educational extension agents* (for example, one modeled on the system of county agents and extension specialists used in agricultural R&D).
- o Sponsorship of *field demonstrations of R&D results.*
- o Provision of *fellowships for practitioners and other R&D users* to work in R&D institutions.
- o Inclusion of *practitioners and other R&D users on project review panels and advisory councils.*
- o *Funding local school districts* to establish organizational units that conduct R&D.
- o Organization of *resource centers* where practitioners and others can find solutions to problems.
- o Support for a *mechanized dissemination system* for distributing R&D results.
- o Support for a *mechanized data-collection system* for detecting educational problems.

In this Working Note we will consider alternatives for linking R&D to external communities at the strategic level, but we will not present detailed models for implementing the linkage strategies. At the detailed level, our attention will be limited to organizing and managing R&D. We will exclude organizing and managing the linkage of R&D to policymaking and practice. In our judgment, the task of developing detailed models for organizing and managing implementation is so complex that it should be considered in a separate analysis.

Supporting Objectives

Objective V: To conduct a program of policy studies on the problems of American education and educational R&D.

The NIE Director will be responsible for allocating resources to the NIE's programs and establishing overall managerial and organizational policies. In making these decisions, the Director will consider the problems of American education and determine how educational R&D can be most effective in resolving these problems. To assist the Director in considering these factors, a program of policy study of education and educational R&D should be conducted within the NIE. The policy study program would provide the Director with recommendations for and assistance in the planning of new NIE programs, assessments of existing NIE programs, and recommendations for improved organizational and managerial policies--all based on studies of the state of American education.

The current NIE legislation* specifies that the Director of the NIE will be responsible to the Assistant Secretary of Education in the Department of Health, Education, and Welfare. As part of this responsibility, the Director will be called upon to assess the implications of educational R&D for federal educational policies considered by the Assistant Secretary. The NIE's policy study program could support the Director in meeting this responsibility as well. In performing this function, the policy studies program would provide a vital link between educational R&D and educational policymaking.

Policy study differs from other kinds of R&D activity in a number of ways. First, it is decision-oriented: its purpose is to generate and evaluate alternative ways to make a particular decision. Secondly, it is ordinarily high-level and contextually specific. The decisions studied are ones made by high-level management in a particular organization. Thirdly, policy study is best performed by

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*Higher Education Act of 1965, Title III, as amended 23 June 1972, Sec. 405.

multidisciplinary teams, since typically a broad range of social economic, technical, and political factors are considered, and a wide range of methodologies are employed.

Objective VI: To improve the quality and quantity of educational R&D manpower in subject areas and skills where the need is great.*

Almost every activity undertaken by NIE will have the indirect effect of training educational R&D manpower or building institutional capacity, or both. This objective implies the need for activities aimed at the direct development of the supply of competent educational R&D manpower. This can be done in a number of possible ways:

- o *Attraction of highly qualified R&D performers* from other fields into educational R&D.
- o *Traineeships, particularly for university students,* for instruction in skills and subject areas.
- o *On-the-job subsidies* for trainees to participate in R&D projects.

Objective VII: To increase the number of effective educational R&D institutions.*

This objective implies the need for activities to support the development of permanent institutions for conducting educational R&D. A number of methods can be used to build R&D institutions directly:

- o Grants to institutions for the support of R&D in designated subject areas--*R&D centers.*
- o Grants to institutions for the support of R&D in undesignated subject areas in amounts determined by criteria not directly dependent on performance--*formula grants.*
- o Grants to institutions for the purpose of paying overhead and other institutional costs--*core grants.*

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*Levien, op. cit., p. 36.

These methods can be used either for developing new institutions in areas of need or for maintaining existing ones on a continuing basis.

Balanced Approach

Our strategies for organizing and managing the NIE will be based on the assumption that has guided most NIE planning, that some R&D activity responsive to each of the objectives should be supported in every strategy in order to maintain a balanced educational R&D system. It appears that few R&D agencies have adopted this policy in their early years; thus, the NIE would be relatively unique in adopting a balanced approach to the support of R&D.

II. BASIC ELEMENTS IN ORGANIZATIONAL AND MANAGERIAL DESIGN

ORGANIZATIONAL DESIGN

Two basic elements in designing an organization are the *division of responsibility* among the major units of the organization and the *organizational structure*. "Division of responsibility" refers to the assignment of activities to the various parts of an organization. It is usually reflected in the labels that appear in the boxes of an organization chart. "Organizational structure" refers to the method used to coordinate activities that require cooperation among an organization's major parts. It is sometimes reflected in the arrangement of connections among the boxes of an organization chart. These two considerations are not the sole determinants of organization, but they do make a significant difference in how an organization functions and, presumably, how well it accomplishes its objectives.

Division of Responsibility

A basic concept in organization theory is the notion of a superior/subordinate relationship between a director and a number of working groups called *major units*. Each major unit in an organization is assigned a share of the total responsibility.

The purpose of this section is to discuss desirable alternatives for the division of the NIE's responsibilities among major units. Other aspects of the relationships among these major subunits and between the major subunits and the director will be deferred until the next subsection entitled "Organizational Structure."

The NIE's mission could be divided among major units in a number of ways. Among the most commonly suggested are:

- *By scientific discipline.* The scientific disciplines relevant to education can be grouped into general categories. One suggested categorization includes natural sciences, social sciences, behavioral sciences, and information sciences.

- *By school-age group.* The division of responsibility by school-age categories does not have to coincide with the usual divisions of the education system, but other categorizations might be awkward. The education system divides easily into early childhood, elementary, secondary, higher education, adult education, and continuing education.
- *By geography.* Division of responsibility could be determined by geographic region: northwest, west, north central, mid-central, south, and northeast.
- *By problem area.* A comprehensive categorization of problems of educational R&D is more difficult to develop in education than in some other social problem areas. In health, the categories could be cancer, neurological disease, arthritis, metabolic diseases, and so forth. In education, one possible categorization* is equal access to education, the quality of education, and effective use of resources.
- *By subject area.* Subject areas are distinguished from problem areas principally in that subject areas denote fundamental categories of continuing concern, while problems are assumed to be topical and finite. In health, for example, the optical system and the cardiovascular system are subject areas. In education, a possible categorization of subject areas is: the instruction and learning process, administration and management, measurement and evaluation, and education systems (strategic alternatives in education).
- *By R&D objectives.* Since we have proposed seven NIE objectives, the NIE could have seven major units, or some of the objectives could be combined to yield fewer major units. A possible grouping would be: national problem-solving (Objective I); research and development, including fundamental research

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*Levien, R. E., *National Institute of Education: Preliminary Plan for the Proposed Institute*, R-657-HEW, The Rand Corporation, February 1971.

(Objective III), practice-oriented R&D (Objective II), linkage of R&D with all components of educational policy-making and practice (Objective IV), improving educational R&D manpower (Objective VI), and institutional development (Objective VII); and policy study (Objective V).

Although there are many ways to divide responsibility among the NIE's major organizational units, two appear to be more advantageous than the others: division by subject area and division by R&D objectives. The following reasons are given:

- Division *by scientific discipline* would pose problems if the NIE were to support the seven proposed R&D objectives. Most of these objectives require major contributions from performers outside the academic disciplines, and these performers would be likely to be deterred from contributing if the NIE were aligned solely with the acaderic disciplines.
- Division *by school-age group* would align the NIE's major units with components in the existing education system and the Office of Education, since both use the categories of pre-school,* elementary, secondary, and higher education. Such an alignment would match the highly organized groups of practitioners and researchers associated with each of these sections with the NIE's major units. This correspondence could be expected to inhibit the generation of unconventional or cross-cutting solutions to educational problems and to increase the chance that the NIE would become the "captive" of strong, existing educational constituency groups.
- Division *by geography* would split the NIE into several regional and, presumably, identical institutes. As a result, the scarce supply of funds, knowledge, and educational R&D management personnel would be distributed across several

*The Office of Education does not have an early childhood bureau.

almost managerially separate institutions, and consequently their effect would be diluted.

- Division *by problem area* would appeal to some of the NIE's sources of financial and constituency support, but would also create some difficulties. The division of responsibility by problem area would tend to discourage long-range, knowledge-building activities in favor of short-term problem-solving activities, and would tend to increase the danger of institutionalizing a particular set of problems and resource allocations in the NIE's organizational structure.*

Division *by subject area* is a desirable alternative. Subject areas can be chosen to cut across age groups, research disciplines, and problems, leaving considerable resource allocation flexibility.

Division *by R&D objectives* is also a desirable alternative since the full range of R&D performers and practitioners could be expected to be attracted to such an organization, and resource allocation flexibility among education problems would not be hindered. Division by R&D objectives would attract performers because each specialty (fundamental researchers, developers, policy researchers, and so forth) could find a unit aligned with their time perspective and professional goals. Resources could be easily reallocated among problems: activities could be changed within the major units to reflect changing problem priorities without the necessity of significantly altering the proportion of resources allocated to each R&D objective. Since there is no compelling rationale for deciding what proportion of the NIE's resources ought to be allocated to each R&D objective at any point in time, these proportions are not likely to require as frequent adjustment as are problem priorities.

Thus, two alternatives for dividing responsibility among the NIE's major units seem most desirable: division by subject area and division by R&D objective. If division by subject area is chosen, most of the

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*The alternative of labeling the major units by problem, but designing a management mechanism to support entirely different objectives, is ruled out.

R&D objectives will have to be supported in each major unit. If division by R&D objective is chosen, most subject areas will be of concern to each unit.

Although division by disciplines, school-age groups, geography, and problem area does not seem desirable for the major units of the NIE, these divisions would be appropriate and desirable within the NIE's major units of organization. However, different divisions would be appropriate within different major units. Division by discipline, for example, would be appropriate in a major unit responsible for fundamental research but not within one responsible for problem-solving.

Organizational Structure

There are three different ways of relating and coordinating the efforts among the major units of an organization; each represents a basic organizational structure. These three basic variants, which have been used by federal agencies and industrial firms in conducting R&D, are the linear structure, the linked structure, and the matrix structure. The linear structure is the simplest form and is probably the most commonly used by R&D organizations. The linked and matrix structures are more complex forms that are used to increase coordination among the major units of an R&D organization.

Coordination, in general, involves the exchange of information and the allocation of responsibility among separate activities not immediately under a common manager. Some specific types of coordination needed in organizations are:

- o Sharing knowledge, experiences, and capabilities.
- o Exchanging information on progress, problems, and prospects.
- o Assigning responsibility for interrelated activities.
- o Determining trade-offs among conflicting objectives.
- o Pooling resources to achieve mutually beneficial effects.

Linear Organizational Structure. The linear organizational structure is characterized by an agency director who delegates work

responsibility and a number of major units that are equal in stature and subordinate to the director's authority. Since each employee reports both administratively (for promotions and rewards) and substantively (for guidance in work activities) to his immediate supervisor, the linear structure has *vertical lines of authority*. An outline of the linear structure is shown in Fig. 1.

Any method of dividing responsibility described in the previous section can be used in the linear structure. Agency directors usually divide responsibilities so as to minimize the degree of overlap among the units, although sometimes responsibilities are overlapped intentionally to provide greater flexibility in allocating resources and stimulate competition among the major units. The conventional view, however, is that overlapping responsibilities costs more in internecine conflict than is gained in flexibility and competitively stimulated performance.

Coordination among the major units is achieved through the direct management effort of the agency director. The channels of coordination are, therefore, primarily vertical, passing up and down the lines of authority, to and from the director's office. Horizontal contacts among major units would be relatively infrequent.

More complex organizations may require increased horizontal coordination among major units. The following two organizational structures may be useful.

Linked Organizational Structure. The linked organizational structure is characterized by two mechanisms that increase horizontal coordination: (1) responsibility for coordination is assigned to a separate major unit that is neutral* and equal in stature with the other major units, and (2) key working groups from different major

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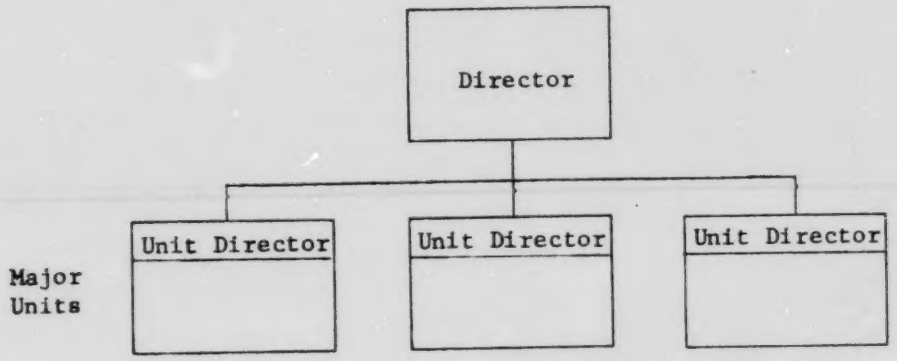
*Neutral in regard to its predominant orientation toward the objectives of any particular major unit. The coordinating unit would, however, be an advocate on selected program issues. A coordinating unit should not be oriented so that it is viewed by the other major units as consistently favoring one or some of the major units (P. R. Lawerence and J. W. Lorsch, "New Management Job: The Integrator," *Harvard Business Review*, Vol. 45, No. 6, November-December 1967, p. 147).

Fig. 1 -- Linear organizational structure



Division of Responsibility

- Any method of dividing responsibility among the major units can be used in the linear structure; e.g., division by discipline, subject area, etc.
- The major units' responsibilities can be shared to promote allocation flexibility and competition or assigned individually to minimize conflict.

Supervisory Relationships

- Each employee works permanently in one major unit.
- Employees are supervised both administratively (promotions) and substantively (work activities) by their major unit director; authority patterns are vertical.

Mechanisms for Coordination

- The organization's director is responsible for coordination among the major units.
- The channels of communication and contact within the organization are predominantly vertical, that is, between employees and their supervisor.
- Horizontal coordination among major units is achieved by communication through authority channels.

units are collocated with each other to facilitate communication. Each of these mechanisms can be applied separately in any organization to increase horizontal coordination, but they are included as the dual features of a linked organizational structure because both increase horizontal coordination by bringing work groups together without significantly changing authority patterns. The linked structure is shown in Fig. 2.

The major unit responsible for coordination in the linked structure is called an *integrating unit*.* Since the integrating unit is equal in stature to the other major units, coordination is not imposed by the director's authority as in the linear structure, but encouraged and monitored through cooperation with the integrating unit. The lines of authority in the other major units would not be significantly altered by the presence of the integrating unit, so conflicts could be resolved by recourse to the director if necessary. However, most coordination would be achieved through negotiation and exchange among equals, with the integrating unit performing an initiating and mediating role.

The responsibilities of an integrating unit should include, in general:

- *Examining the external environment* to determine current problems and estimate future problems requiring R&D attention.
- *Organizing internal efforts* to address these problems by bringing together appropriate skills within the organization and initiating work efforts.
- *Monitoring progress in the major units* to determine difficulties and convey findings to the other major units.
- *Resolving intraorganizational conflicts* arising among different work groups.

The integrating unit should not have the sole responsibility for carrying out any of the organization's R&D objectives, except for

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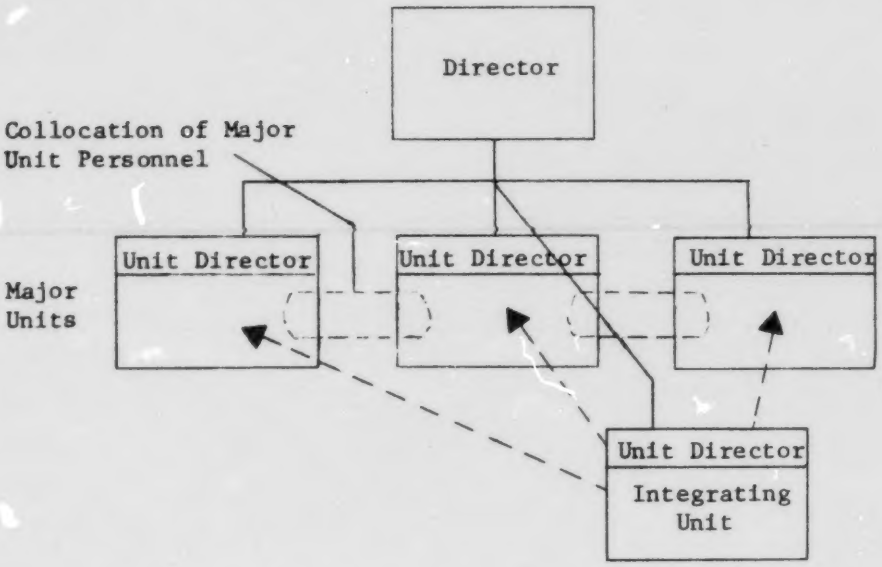
*Ibid., pp. 142-151.

Fig. 2 -- Linked organizational structure



Division of Responsibility

- Any division of responsibility among the major units can be used in the linked structure; e.g., discipline, subject area, etc.

Supervisory Relationships

- Each employee works permanently in one major unit.
- Employees are supervised both administratively (promotions) and substantively (work activities) by their major unit directors; authority patterns are vertical.

Mechanisms for Coordination

- An integrating unit is responsible for coordinating among the major units. The integrating unit is equal in authority to the other major units and adopts a neutral position in dealing with the other major units.
- Coordination is also achieved through selective collocation of major unit personnel.
- Horizontal coordination among major units is achieved through cooperative efforts stimulated by the integrating unit and through collocation.

some types of policy study activities included under Objective V. The integrating unit should, however, directly assist the other major units in carrying out their responsibilities (for example, by providing direct assistance in program planning and evaluation).* The involvement of the integrating unit in the everyday activities of the other major units would be a principal means of influencing program content and management policy.

The types of policy studies that the integrating unit should undertake are problem analyses and decision analysis studies directly useful in coordinating the NIE programs. These studies could be a substantial portion of the integrating unit's total activities without violating the integrating unit concept. All other policy studies, particularly those with a broad, long-range orientation, should probably be performed elsewhere in the organization. There are two reasons for this. First, the integrating unit should be primarily involved in the day-to-day management of the NIE, which would be incompatible with the perspective needed for conducting long-range policy studies. Secondly, if the integrating unit assumed responsibility for long-range, broad perspective policy studies, it would be shifted away from its necessary position of neutrality in relation to the orientations of the other major units. However, while not responsible for performing these long-range policy studies, the integrating unit should definitely include that activity as part of its coordinative role.

One example of an integrating unit is the Systems Engineering Department in the Bell Telephone Laboratories. Systems Engineering is responsible for monitoring the interfaces between basic research laboratories, components laboratories, system development laboratories and production, and guiding the work in these units toward Bell system needs. Additional examples of integrating units can be found in other industrial R&D organizations.

The second mechanism for increasing coordination in a linked structure--collocation of key working groups from major units--

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*Ibid., pp. 142-151.

is a way of overcoming communication barriers existing among working groups that do not report directly to a common director. Collocating these groups without changing the organizational structure, even to the extent of moving a working group away from its major unit, is usually effective in eliminating the communication barrier. In general, it has been found that collocation is not effective unless it is "close," which means that collocation on the same site but in separate buildings, or even on different floors of the same building, is rarely sufficient to generate enough intergroup contact.

In the Bell Telephone Laboratories, horizontal communication is needed between engineering development laboratories and Western Electric manufacturing facilities. These facilities are separated organizationally and geographically, but must coordinate their efforts. To achieve this coordination, some personnel from the development laboratories and some from Systems Engineering work in the Western Electric manufacturing facilities alongside Western Electric production engineers.*

One criticism of the linked structure is that the integrating unit's role in an organization is ambiguous. The integrating unit is accountable for an organization's total performance but has no authority to command action, which is an unattractive situation for many managers. Moreover, the contribution of members of an integrating unit to the overall effort is difficult to identify, which makes their performance difficult to assess.

Matrix Organizational Structure. One solution for the problems that arise in linked organizations is to achieve coordination by having an employee in an organization work for two supervisors, each having different responsibilities, but each with a need to coordinate his efforts with other activities in the organization. This leads to a matrix organizational structure. Matrix structures have been adopted by a number of R&D organizations, including the National Aeronautics and Space Administration's Goddard Space Flight Center and the National Cancer Institute.

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*J. D. Morton, *Organization and Innovation: A Systems Approach to Technical Management*, McGraw-Hill Book Company, New York, 1971, p. 62.

The matrix structure is characterized by the division of an organization's responsibilities into two classes; each of the classes is called a dimension of the organization. These dimensions are then divided into one or more major units of organization according to one of the divisions of responsibility discussed in the previous section. Different divisions of responsibility can be chosen for each dimension.

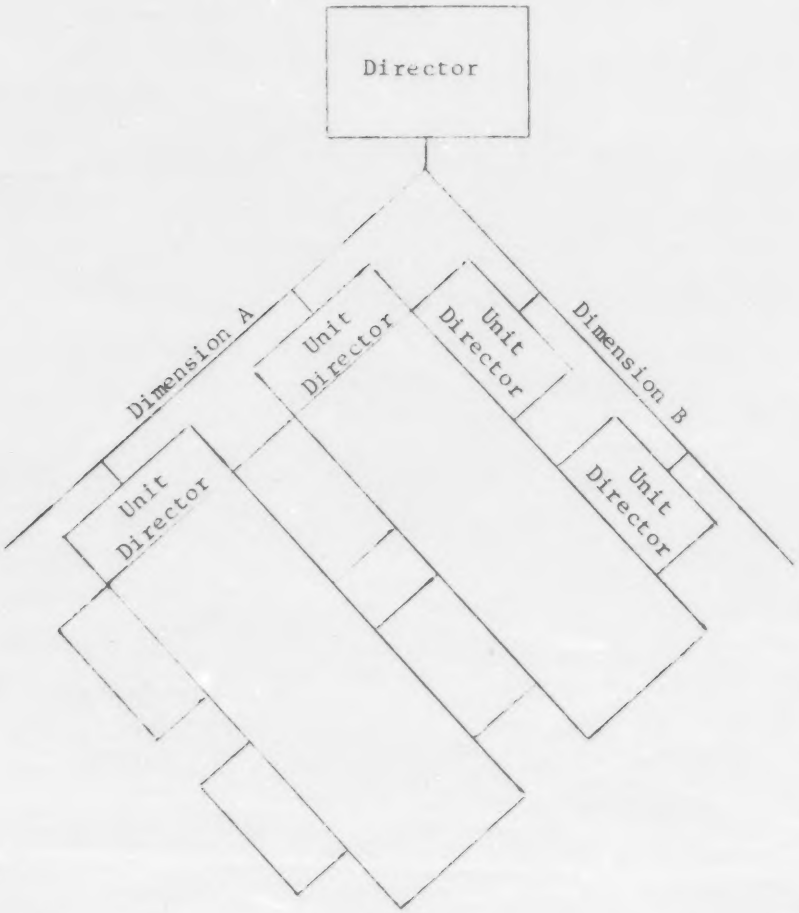
Coordination is achieved in this organizational arrangement by having many of the personnel in the organization work for the directors of two major units, one in each dimension of organization. Usually, employees report administratively (for promotions and rewards) to one of the major unit directors and substantively (for direction on work activities) to one or both major unit directors. This two-dimensional arrangement is the source of the term "matrix" for this organizational structure. The matrix organizational structure is summarized in Fig. 3, in which the "matrixing" of personnel reporting is indicated by overlapping the boxes representing major units on one dimension of organization with the boxes representing major units on the other dimension. The intersections represent personnel who report to the two respective major unit directors.

An employee's reporting relationship can be one in which no substantive work is performed for the major unit director to whom an employee reports administratively or one in which different substantive tasks are performed simultaneously for both major unit directors. Also, employees can be collocated with either of the major units, or with both, depending on the degree and type of coordination desired.

Experience with the matrix structure in R&D management indicates that it is important to adopt the following organizational policies:

- The programs or projects in one dimension of organization should be temporary; that is, last only a few years and then be disbanded.
- The major units in the other dimension of organization should have responsibility for and funds to pursue some of the organization's R&D objectives.

Fig. 3 -- Matrix organizational structure



Division of Responsibility

- Part of the organization's responsibility is divided among major units in Dimension A, part among major units in Dimension B.
- Different divisions of responsibility can be used in each dimension.

Supervisory Relationships

- Each employee reports administratively (promotions) to one major unit director.
- Most employees report substantively (work activities) to two major unit directors.
- Authority relationships are two-dimensional and are, therefore, matrixed.

Mechanisms for Coordination

- Horizontal coordination across major units is achieved through dual supervisory relationships. These relationships are equivalent, in effect, to transferring personnel frequently among major units.

The first policy reduces competition for staff between the directors of major units on different dimensions. When the major units in both dimensions are permanent, the experience has generally been that to prevent the loss of staff to other units, unit directors discourage sharing arrangements and undervalue the assistance that personnel provide to other units. Both factors tend to decrease the incentive that employees have to work for two major unit directors, which in the long run results in a conversion of the matrix structure to a linear structure.

The second policy is intended to provide the major units on the permanent dimension with the means for building a broad base of personnel resources. The broader this base, the more quickly and authoritatively the major units on the temporary dimension will be able to respond to new responsibilities and activities by drawing from the permanent pool. Another reason for the second policy is that it aids in recruiting competent management talent for the permanent dimensions. Most managers need to have some responsibility for allocating resources as a component of job satisfaction.

Selecting an Organizational Structure. Research on industrial R&D organizations* and observation of government R&D agencies indicate that R&D organizations perform more efficiently if there is (1) high differentiation in skills, professional goals, time perspective, and degree of control among an organization's major working units; and, simultaneously, (2) high integration (coordination) of those major working units. These observations favor either the linked or the matrix forms of organization, since these structures facilitate grouping similar personnel together in separate major units (differentiation) and coordinating the individual efforts of these units toward common purposes (integration). The linear structure does not have these advantages, but it will not be eliminated from consideration

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*P. R. Lawrence and J. W. Lorsch, *Organization and Environment: Management Differentiation and Integration*, Richard D. Irwin, Inc., Homewood, Illinois, 1969.

because of its widespread use in federal R&D agencies. Consequently, each of these three organizational structures will be considered for the NIE.

BASIC MANAGEMENT STYLES

The management process for an R&D program can be divided into seven parts, as shown in Fig. 4: program planning, project generation, project selection, project monitoring, project utilization, project evaluation, and program evaluation. The five activities relating to project management are usually performed in a closed, continuing cycle, which will be called program development. All seven activities are described in detail in Table 1.

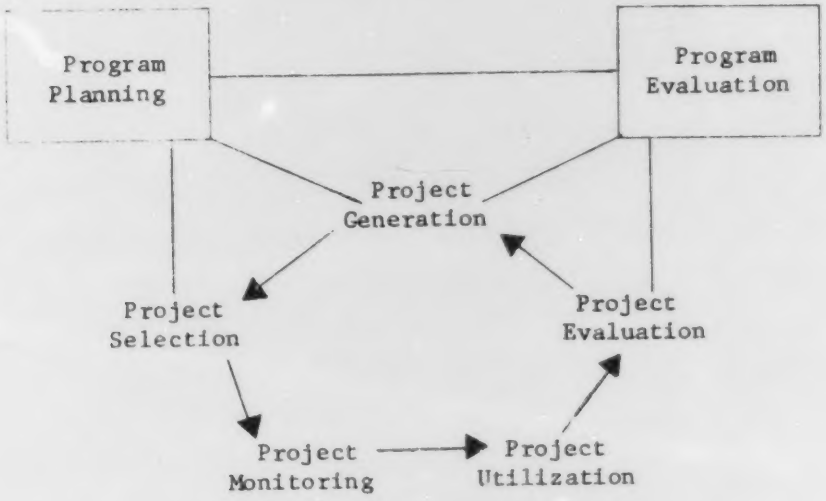

Fig. 4 -- Relationships among parts of the R&D management process

By choosing particular policies for each part of the R&D management process, it is possible to create different overall *management styles* for managing R&D. Five different management styles are presented in this section. The criterion for choosing policies to create these styles is *the degree of control over program content* exerted by federal program managers. The styles range from directed management with considerable control over program content to management with

Table 1

THE R&D MANAGEMENT PROCESS

R&D Management Process	Activities
Program planning	Detection and incubation of new program ideas. Determination of an initial program strategy and objectives. Reassessment and readjustment of program objectives and allocation priorities (a continual process).
Program development[a]	Project generation: creation of project concepts and preparation of proposals (responsive to program objectives and program evaluations). Project selection: determination of projects to support (responsive to program objectives). Project monitoring: technical assistance to project performers, communication of problems and results among projects, assessment of substantive progress, redirection of effort, and fiscal auditing. Project utilization: encouraging the use of project results. Project evaluation: assessment of project accomplishments, recommendations for future efforts, and evaluation of project performers.
Program evaluation[b]	Assessment of the substantive and managerial accomplishments of a program or programs. Recommendations for changes in program objectives, priorities, and management.

[a]Program development is described in terms of a number of interrelated projects.

[b]Program evaluation and program planning have assessment of program objectives and priorities as common activities, indicating an area of overlap.

little or no control. The choice of styles to span this range is somewhat arbitrary since, as readers will observe, there is actually a continuum of possible styles between these two extremes.

Management policies can be implemented in a number of ways so that considerable variation in management procedures and techniques is possible. Many of these variations are discussed in detail in Secs. III through V.

Directive Management Style

The *directive management style* outlined in Table 2 provides the most control by federal managers over program content. The principal distinguishing feature of this style is its almost *total reliance on internal staff* to perform all management activities.* All program decisions are made by internal management staff in close consultation with a large, highly qualified intramural research staff. Unlike any of the other management styles, *each part of the management process receives about equal emphasis.*

Observations of existing R&D organizations suggest that in managing highly directed R&D it is extremely important to have a large, intramural R&D staff available to use as consultants in decisionmaking and as a source of program and project ideas. Without a staff that is *integrated with the management team,*** several difficulties are likely to arise. One is that significant R&D events and opportunities may too frequently pass unrecognized and unexploited. Another is that decisions may be made with inadequate information because of the inconveniences of using a large number of external consultants and the unfamiliarity of those consultants with other aspects of a directed program. A third difficulty is that program coherence may be lost by relying on external sources for project ideas; this reliance divorces project generation from program planning and separates what should be highly interactive activities in directed management.

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*Most federal R&D agencies rely on the external scientific community to a greater or lesser extent in many management activities.

**Internal consultants.

Table 2

DIRECTIVE MANAGEMENT STYLE

GENERAL MANAGEMENT POLICIES

All decisions are made by internal, centralized management staff.
Decisionmakers rely on intramural research staff as the principal source of technical advice and assistance. Consequently, the intramural staff should be large and highly competent.
Equal effort is devoted to all parts of the R&D management process.
A high ratio of management staff to project budget is maintained.

PROGRAM PLANNING POLICIES

Programs are planned in detail and continually replanned.
Specific end objectives are determined.
A written plan is produced to explicitly identify important independent variables (the alternatives) and dependent variables (the end objectives and intermediate objectives).
A system for measuring progress is established and used for management control.
Activities are coordinated for convergence to the planned end.

PROGRAM DEVELOPMENT POLICIES

Project ideas are generated internally.
Project selection and performer selection are separate activities.
Projects are selected by internal staff to fit the overall plan.
Potential performers bid on the selected projects.
A contract should be awarded to the bidder offering the best balance of (1) responsiveness to project objectives, (2) technical expertise, and (3) low cost. Contractors should be selected by internal staff.
Project performance is closely monitored.
Technical assistance is provided.
Progress toward project objectives is reviewed and efforts redirected as needed.
A plan for project utilization is included as part of every project.
All projects are carefully evaluated.
The internal staff analyzes project results to find implications for further work.
Each performer's accomplishment is recorded and kept on file for future reference in awarding contracts.

PROGRAM EVALUATION POLICIES

Programs are regularly and frequently evaluated.
Progress toward program objectives is reviewed.
Revisions in program objectives and management procedures are recommended.

Agencies that use a directed management style (for a portion of their total program) are NASA's Goddard Space Flight Center and the National Cancer Institute.

Centralized Management Style

Every management policy included in the directed management style serves to maximize management's control over program substance. By relaxing some of these policies, a management style with an intermediate level of directedness can be created. The policies for implementing this type of management, which will be called the *centralized management style*, are listed in Table 3.

The principal difference between directed management and centralized management is that centralized management makes *greater use of the external R&D performer community to generate project ideas, consult on project selection, and participate in program evaluations.* In addition, program planning in centralized management is less detailed; it is limited to statements of program objectives and priorities that are disseminated to the external R&D community, although internal management and intramural research staff might determine some research topics related to a particular objective (equivalent to identifying independent and dependent variables of high-priority interest in Table 3) and solicit project proposals directed to those topics.

The National Science Foundations' Research Applied to National Needs (RANN) program uses a style of management very similar to this centralized management approach.

Interventionist Management Style

A third management style is created by further relaxation of the policies for exerting control over program substance. The result will be called the *interventionist management style.* Program content is *determined largely by the interests of the external R&D community; the management staff intervenes in neglected and emerging problem areas* to stimulate greater interest in the R&D community.

All program decisions are made by the management staff, but they rely entirely on the performing community for consultation and advice.

Table 3

CENTRALIZED MANAGEMENT STYLE

GENERAL MANAGEMENT POLICIES

All decisions are made by internal, centralized management staff.
Decisionmakers rely on both intramural research staff and extramural performers for technical advice and assistance.
More effort is devoted to the *program planning and project selection* than to the other parts of the management process.
A moderate ratio of management staff to project budget is maintained.

PROGRAM PLANNING POLICIES

Programs are formally planned but in less detail than in the directive management style.
General end objectives and priorities among these objectives are determined and supported with analytical evidence.
Some independent and dependent variables of high-priority interest are identified.
Information regarding program objectives and high-priority interests is disseminated to prospective performers.

PROGRAM DEVELOPMENT POLICIES

Project ideas are generated by the performer community.
Projects are selected by the internal staff.
The portfolio of projects is balanced regarding (1) program objectives, (2) technical quality, and (3) opportunity to support a promising new R&D performer.
Performers are awarded *contracts* for performing the proposed work.
Extramural performers are consulted on project selection.
Project performance is not closely monitored.
Progress toward project objectives is reviewed.
A plan for project utilization is included as part of every project.
Projects are evaluated.
The internal staff analyzes project results to find implications for further work.

PROGRAM EVALUATION POLICIES

Programs are regularly evaluated, but at infrequent intervals.
Revisions in program objectives and management procedures are recommended.

Program planning is limited to identifying gap areas and nurturing promising new kinds of activities, but most of the management staff's efforts are devoted to project selection. Performance is not closely monitored, but programs are periodically evaluated primarily to assist the management staff and the performing community in reassessing what the program priorities should be for the future. A detailed description of this interventionist management style is given in Table 4.

The National Science Foundation's Research Division uses interventionist management in many of its programs.

Decentralized Management

Decentralizing decisionmaking authority and most management functions to regional R&D facilities creates a fourth management style. The management staff at the federal level retains about the same amount of program control as in the interventionist management by evaluating each regional facility's program on a regular basis to assess program changes that should be made. These evaluations are then used in determining the share of resources that each regional facility should receive. The *decentralized management style* is described in Table 5.

A form of management similar to the decentralized style is used by the Cooperative State Research Service in the Department of Agriculture to manage the State Agricultural Experiment Stations. The National Institutes of Health also use this type of management in a number of R&D centers associated with universities.

Laissez-Faire Management

Minimum control over program content can be achieved by emphasizing the project selection part of management and relying on a *panel of peers from the R&D community to select projects*. The internal staff retains only the indirect influence of affecting the choice of peer reviewers as its principal means of controlling program substance. It is difficult for the internal staff to determine the total composition of the peer review panels when the panel has decisionmaking authority. The *laissez-faire management style* is described in Table 6.

Table 4

INTERVENTIONIST MANAGEMENT STYLE

GENERAL MANAGEMENT POLICIES

All decisions are made by internal, centralized management staff.
Decisionmakers rely on extramural performers as the principal source of technical advice and assistance.
More *effort is devoted to project selection* than to any other parts of the management process.
A moderate ratio of management staff to project budget is maintained.

PROGRAM PLANNING POLICIES

Programs are planned informally.
Substantive *gap areas* are identified in consultation with extramural performers and the R&D user community.
The *significance of problems is assessed* as a guide to allocating funds within and among programs.
The management staff *recruits* performers in gap areas and priority areas as a means of shifting priorities.
Conferences and workshops are conducted to stimulate coordination and communication.

PROGRAM DEVELOPMENT POLICIES

Projects are proposed almost entirely by the performer community instead of internal staff.
Projects are selected by management staff.
The portfolio of projects is balanced regarding (1) program priorities, (2) technical quality, and (3) opportunity to support promising new R&D performers.
Performers are supported by a *grant* to perform the proposed work.
Extramural R&D performers are consulted on project selection.
Project performance is not closely monitored.
Projects are evaluated.
The internal staff analyzes project results to find implications for further work.

PROGRAM EVALUATION POLICIES

Programs are regularly evaluated, but at infrequent intervals.
Revisions in program priorities and management procedures are recommended.

Table 5

DECENTRALIZED MANAGEMENT STYLE

GENERAL MANAGEMENT POLICIES

Decisionmaking authority is shared with a number of regional facilities.
Decisionmakers rely on extramural performers as the principal source of technical advice and assistance.
More emphasis is given to program evaluation than to the other parts of the management process; regional decisionmakers emphasize the other parts.
A moderate ratio of management staff to project budget is maintained.

PROGRAM PLANNING POLICIES

Each region plans its own R&D programs.
Federal managers assist the regions in program planning.
Federal managers audit the program plans to check for duplication of effort across regions.

PROGRAM DEVELOPMENT POLICIES

Projects are generated by regional performers.
Projects are selected by regional management.
Projects are monitored by regional management.
Projects are evaluated by regional management.

PROGRAM EVALUATION POLICIES

Federal managers regularly evaluate the regional programs.
Progress toward program objectives is reviewed.
Revisions in program objectives and management procedures are recommended.
The evaluation results are used as a basis for allocating resources to the regions.
The evaluation results are incorporated in regional planning.

Table 6

LAISSEZ-FAIRE MANAGEMENT STYLE

GENERAL MANAGEMENT POLICIES
Decisions are made by a panel of extramural R&D performers. *These extramural R&D performers rely primarily on their own expertise in decisionmaking.* *Project selection is the only part of management that is emphasized.* *A low ratio of management staff* to project budget is maintained.
PROGRAM PLANNING POLICIES
Programs are not regularly planned.
PROGRAM DEVELOPMENT POLICIES
Projects are generated by extramural performers. *Projects are selected by a panel of extramural R&D performers.* *Performers are supported by a grant to perform the proposed work.* *Projects are not substantively monitored or evaluated.*
PROGRAM EVALUATION POLICIES
Programs are rarely evaluated.

Summary of Management Styles

The five distinct management styles are summarized in Table 7. The effect of each policy on the management is marked by a symbol: a plus sign (+) indicates increased control, a minus sign (-) indicates decreased control, and a zero (0) indicates intermediate control. The overall pattern of symbols displays graphically the extent to which some of the management styles provide more program control than others.

Although the degree of control over program content has been the criterion for developing alternative management styles, it is not the only criterion that could have been used. Ability to attract R&D talent into a field of R&D, receptiveness to new ideas, and freedom from conflicts of interest are some of the other criteria that could have been used. The management styles presented here do not necessarily compare to each other in the same way in terms of these other criteria as they do in terms of ability to exert program control.

PLANS FOR ORGANIZING THE R&D PERFORMER COMMUNITY

The final basic element of the NIE's design is a plan for organizing the R&D performer community for maximum effect on educational practice. Studies of R&D suggest that R&D organizations have to make four basic choices in deciding how to organize their performer communities:

1. How will high technical quality be ensured in the R&D conducted?
2. How will the educational R&D conducted be made relevant to practice?
3. How will the R&D results achieved be translated into changes in educational practice?
4. How will constituency support for R&D be established in the user and the R&D communities?

Each of these choices can be made in a number of ways. Thus, there

Table 7

SUMMARY OF MANAGEMENT STYLES

Management Policies	Type of Management				
	Directive	Centralized	Interventionist	Decentralized	Laissez-Faire
General Management Policies					
Decision authority	Internal management staff (+)	Internal management staff (+)	Internal management staff (+)	Shared with regional decisionmakers (-)	Extramural performers (-)
Source of expertise for decisionmakers	Intramural staff (+)	Intramural staff and extramural performers (0)	Extramural performers (-)	Performers in regional facility (-)	Extramural performers (-)
Emphasis on parts of the management process	All parts emphasized equally (+)	Program planning and project selection (0)	Project selection (-)	Program evaluation (0)	Project selection (-)
Ratio of management staff to project budget	High (+)	Moderate (0)	Moderate (0)	Moderate (0)	Low (-)
Program Planning Policies	Specific objectives (+) Measurement of progress (+) Convergence of activities (+) Written plans (+)	General objectives (0) Key projects identified (+) Information on program objectives disseminated (+)	Gap areas identified (0) Significance of problems assessed (0) Performers recruited (+)	Plans prepared by regions (-)	No regular planning (-)
Program Development Policies					
Project Generation	Intramural and management staff (+)	Management staff and extramural performers (0)	Extramural performers (-)	Regional performers (-)	Extramural performers (-)
Project Selection	Contract to perform specific task awarded to winner of proposal competition (+); selection by internal staff using intramural advice (+)	Proposed work done on contract (+); selection by internal staff using extramural and intramural advice (0)	Proposed work supported on a grant (-); selection by internal staff using extramural advice (0)	Institutional form of support (-); selection by regional staff (-)	Proposed work supported on a grant (-); selection by a panel of extramural R&D performers (-)
Project Monitoring	Close monitoring for substance (+)	Partial monitoring for substance (0)	No monitoring (-)	Regional monitoring (-)	No monitoring (-)
Project Utilization	Plan included in proposal (+)	Plan included in proposal (+)	No direct effort (-)	No direct effort (-)	No direct effort (-)
Project Evaluation	Rigorous performance evaluation for use in subsequent awards (+); substantive review (+)	No performance evaluation (-); substantive review (+)	No performance evaluation (-); substantive review (+)	Regionally evaluated (-)	No evaluation (-)
Program Evaluation Policies	Regular and frequent substantive evaluation (+)	Regular but infrequent substantive evaluation (0)	Regular but infrequent substantive evaluation (0)	Regular substantive evaluation (+,0); evaluations form the basis for regional planning (+)	No evaluation (-)

NOTES: (+) implies policy tends to increase federal management's control over program substance.
(-) implies policy tends to minimize federal management's control over program substance.
(0) implies policy tends to have an intermediate effect.

are in theory a large number of plans for organizing the R&D performer community. The number can be reduced, however, by selecting a few that are judged most distinct from each other and that are apparently useful in educational R&D.

No single plan can be presented as superior, for there are many reasons for and against each of the ways of making the four basic choices and very little consensus on which of these reasons are most important in educational R&D. These different ways of making the four basic choices represent, in effect, different schools of thought on what should be emphasized in organizing the R&D performer community. Each school accepts an internally consistent system of beliefs and acts accordingly, but the beliefs of one school conflict with the beliefs in the other schools. This is an important point, for there are numerous apparent conflicts in deciding how to organize the R&D community. Formulating these conflicts as choices emphasizes clearly that there is no single best way to resolve them. Some possible ways of making these choices are discussed in the following subsections.

Achieving R&D of High Technical Quality

One way (or policy) that could be chosen to achieve high technical quality in conducting R&D would be to concentrate on building strong peer groups within the educational R&D community and to separate them institutionally from the user community. One means of strengthening these peer groups would be to stress attracting highly qualified R&D performers from all disciplines into educational R&D. The peer group would be relied upon to establish and set high technical standards of R&D performance through their usual methods.*

The peer groups would also be considered the most effective way of generating fundamentally new ideas for education, and these ideas would be considered essential for ultimately achieving significant

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*Hagstrom, W. O., *The Scientific Community*, Basic Books, New York, 1965.

improvements in educational practice. It would be believed that most of the existing ideas in educational R&D have been tried and seem to make little difference.*

A second policy choice could be to emphasize building a broad knowledge base as essential to achieving significant advances in solving educational problems, similar to the first policy, but unlike the first policy, to rely on evaluating carefully prepared project plans as the primary means of setting technical standards. The belief would be that peer groups in educational R&D could not be made strong enough in the near future to set high enough technical standards with sufficient uniformity.

A third policy could be to put less emphasis on the need for fundamental knowledge as a prerequisite for important advances in educational R&D and to rely more on invention in an actual educational environment for achieving significant educational advances. Adoption of this policy would follow from the observation that significant change in education can occur without waiting for the results of R&D, as it has in many other fields.** The intuitive creators among educational practitioners and others have produced many educational innovations and more will appear with or without R&D. Many of these innovations have been put into widespread practice, but often they have been adopted without an adequate understanding of their long-term effects or their relationship to educational goals. This lack of understanding leads to perpetual change without improvement, and can often result in difficulties

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*H. A. Averch, S. J. Carroll, T. S. Donaldson, H. J. Kiesling, J. Pincus, *How Effective is Schooling?--A Critical Review and Synthesis of Research Findings*, The Rand Corporation, R-956-PCSF/RC, March 1972.

**Ubbelohde, A.R.J.P., "The Beginning of Change from Craft Mystery to Science as a Basis for Technology," Charles Singer, et. al. (eds.), *A History of Technology, Vol. IV, The Industrial Revolution, c. 1750 to c. 1850*, Oxford University Press, 1958; de Solla Price, D. J., "Is Technology Historically Independent of Science?" *Technology and Culture*, Vol. 6, Fall 1965; and Ben-David, J. "Roles and Innovations in Medicine," *American Journal of Sociology*, Vol. 65 (May 1960), pp. 557-568.

in replication. A principal role for educational R&D in this policy, then, would be to discipline the inventors and the change process by evaluating which innovations produce valid improvements. As a means of establishing this discipline, R&D would be merged with the invention and change process, eliminating much of the institutional separation that would be established with the first two policies. The result would be what might be called a sizable component of "action research" in the R&D performer community--R&D performers working with inventors in the user community.

Each of these three policies for achieving R&D of high technical quality is summarized in Table 8. The choices are listed under one of three plans for organizing the R&D performer community. These plans will be completed by specifying policies for the three other choices involved in a plan for organizing the R&D performer community.

It should not be inferred from this discussion that choosing one policy precludes even partial use of any of the alternative policies that could have been chosen. On the contrary, in implementing any plan, some policies of the other plans would probably be adopted to some extent.

This analysis deals with what could be emphasized in a plan in distinction to the other plans. For example, in the second policy discussed above, technical standards are set by evaluating carefully prepared project plans. Any organization adopting this policy would, to some extent, also follow the first policy of building peer groups within the R&D community, but would not consider it as important a means of ensuring technical quality as evaluating carefully prepared project plans. Procedures for implementing these emphases are presented in Sections III through V.

Increasing the Relevance of R&D

One policy that could be followed to increase the relevance of the R&D conducted to the problems of users would be to institutionalize appropriate interactions between peer groups in the R&D community and the user community or representatives from the user

Table 8

SUMMARY OF PLANS FOR ORGANIZING THE R&D PERFORMER COMMUNITY

Choices	Plan for Organizing the R&D Performer Community		
	Build R&D Resources	Produce R&D Results	Support Disciplined Change
Achieve R&D of high technical quality	Separate R&D performers from users by building distinct institutional structures in each community. Build strong peer groups within the R&D community. Emphasize the importance of fundamentally new ideas to achieving improvements in education. Rely primarily on peer group processes for setting technical standards of performance. Stress attracting highly qualified R&D performers into educational R&D. Provide stimulating and unencumbered environments to facilitate attracting performers and creating fundamentally new ideas.	Separate R&D performers from users by building distinct institutional structures in each community. Rely on evaluating carefully specified project plans for setting technical standards of performance. Build a broad knowledge base as a prerequisite for significant advances in solving educational problems.	Merge some R&D performers into the user community. Rely heavily upon intuitive and creative inventors for achieving significant educational developments, assuming that a broad knowledge base is not needed for invention to be successful. Discipline the inventive process by subjecting creations to rigorous evaluative research.
Increase the relevance of R&D	Institutionalize interactions between the peer groups in the R&D community and users at judiciously chosen points. Also, institutionalize interactions between the R&D peer groups at judiciously chosen points.	Detect and diagnose problems in the user community. Analyze and plan for the knowledge, development, and reform needed to resolve the problems. Allocate tasks to the R&D performer community.	Support a cumulative sequence of increasingly larger, experimental, educational interventions as the principal innovative activity. In intervening, be guided by long-range objectives, but plan incrementally based on results achieved and opportunities encountered. Use R&D to guide the invention and change process toward the areas of greatest need and opportunity.
Implement the results of R&D	Build a single institutional network in the user community for connecting the R&D and user communities.	Use a variety of mechanisms for linking R&D with users and for linking users with R&D. Use the best mechanism for each kind of situation.	Continue enlarging the sequence of interventions, but shift from experimentation to replication in the mature (later) stages of development. Use other means as needed.
Build constituency for R&D	Do not advocate an approach to solving an educational problem until R&D performers are agreed on its merit.	Do not advocate an approach to solving an educational problem until R&D performers are agreed on its merit. Undertake large-scale, problem-solving R&D to find the best approach even though the R&D community does not agree on how, or if, the problem can be solved.	Organize the R&D and user community to support an experimental intervention program even before it is proved.

community at judiciously selected points. This could be accomplished partly by building strong R&D institutions in all subject areas important to education and by linking these institutions with each other, with the users of R&D, and with R&D performers outside the institutional network. This network of R&D institutions, which could undertake a range of activities from fundamental research to implementation, would be viewed by the NIE as the core of the educational R&D community.

Another means of providing contact between different groups could be to sponsor conferences and workshops structured to fill selected needs. Other means could also be used.

A second policy for increasing the relevance of R&D activities would be for the NIE to assume major responsibility for detecting and diagnosing educational problems and for guiding and frequently directing the educational R&D community into working on these problems. A multiple partnership would be visualized: The NIE would analyze problems and allocate tasks to the R&D performer community; the R&D community would perform these tasks; and the practitioner community would implement the results of R&D.

A third policy for increasing the relevance of R&D is compatible with the third policy for achieving high technical quality improvements through R&D--R&D could be merged with invention and embedded in the educational change process. A likely approach would be to spend a substantial portion of R&D resources on experimental, educational interventions in actual environments. These interventions would be staged to proceed from small-scale, conceptualizing activities at one site to increasingly larger, more comprehensive activities at numerous sites. Each site would have its own R&D component. Adjustments based on both intuition and quantitative measurement would be made iteratively at and during each stage to improve the effect of the intervention. The precision of measurement might be weak at first, but would become increasingly refined in the later stages of development. Many of these sites would, in turn, be multiplied to stimulate further disciplined change and continually improve the effect of the intervention.

The NIE would believe that the data produced by these experimental activities is less important than the experiences and subjective knowledge gained by those conducting the activities. These personnel would use their experiences and subjective knowledge to suggest improvements in the intervention and to train others in its application. Data would be considered important for preventing unwarranted conclusions from being drawn from the intervention activities.

In the mature or later stages of development of an intervention, reducing the operating cost and increasing the transferability of an intervention would be increasingly important objectives. An entire development sequence would be expected to take 10 years or more in a typical case, and great effort would be exerted to support an intervention through difficult periods.

Program planning would be characteristically incremental and not elaborate. Hierarchies of objectives would not be formulated to rationalize programs. Broad objectives would be stated and understood as general directions for R&D activities, but planning within these objectives would be incremental from year to year. The successes and failures of the past year's activities, in addition to new opportunities, would suggest shifts in emphasis and tactics for the next year. These three policies are also summarized in Table 8.

Implementing R&D Results

The next choice in planning the organization of the R&D community--a policy for implementing R&D results--will be treated briefly, since this study is primarily concerned with the organization and management of R&D and not the conversion of R&D results into widespread educational change.

One possible policy would be to spend most of education's resources for implementation on a single, large, institutional infrastructure that links practitioners and other users with R&D. The system would have to be complex and comprehensive to connect completely with the widely distributed and highly varied educational

system. The extension agent system developed by the Department of Agriculture is a good example of an implementation system consistent with this policy.

Another policy could be to emphasize the need for a variety of often institutionally separate linkage mechanisms in both directions between the R&D community and the user community. Linkages would be considered necessary in one direction to distribute the products and knowledge gained from R&D to the user community. Linkages would be considered necessary in the other direction to obtain feedback on the effectiveness of solutions made available to the user community and to keep informed of actual problems there. There would be a strong emphasis on the need to have a great variety of linkage and implementation mechanisms on hand so that the best mechanism would be available for each kind of situation. Many of these mechanisms would only be used temporarily.

A third policy for implementation is a natural extension of the third policy for increasing the relevance of R&D. The R&D approach of staging a multiplicative sequence of experimental interventions could in time lead to implementing the experimental interventions as local practices at a large number of sites across the country. To an increasing degree, these later-generation sites could become parent sites (or centers) for organizing and managing the replication of the intervention at other sites near and similar to the parent sites.

Building Constituency for R&D

The policy used to build constituency for R&D is an extremely important and complicated one for the NIE to consider, but only one aspect will be considered here--whether or not an approach to an R&D program will be advocated vigorously in the R&D performer and user community before R&D has proven the worth of the approach.* Other aspects of a policy for building constituency should be carefully

*House, E. R., *The Development of Educational Programs, Advocacy in a Non-Rational System*, Center for Instruction and Curriculum Evaluation, November 1970.

studied by the NIE, especially through careful examination of policies that other R&D organizations have followed.

As used here, advocacy refers to a limited range of activities: actions undertaken to organize support in the user community and also in the R&D performer community in favor of a particular program approach *before* the R&D community has reached full consensus that the approach is a good one. The traditional norm in the R&D performer community is strongly against advocacy because of the pressures it usually generates to cut corners in the design of R&D projects.

The question of whether or not to emphasize advocacy is most important when conducting experimental interventions in actual educational environments. In running a voucher experiment, for example, the traditional R&D position would, in simplified terms, be strongly in favor of random selection of a site for the experiment, unobtrusively measuring the pretest conditions, setting up an office to distribute vouchers, and then measuring post test conditions, all without other exogenous influences of the Federal Government. Conversely, the advocate's position would be to do some preliminary organizing to find sites where there was greater potential support for the intervention, choose the sites with the greatest likelihood of initial success, and then work with R&D and user community groups before and during the intervention to organize more support for it. The advocates' belief is that although his activities may sometimes force a sacrifice in experimental design, the gain in support to continue the experiment will more than compensate for the loss.

Any program, of course, will be a compromise between these two positions. But, where the balance is struck--on the side of advocacy or on the side of pure experimental design--determines whether or not an advocacy policy will be chosen.

Because of their background and training, few R&D performers will excell in the advocate's role; thus, the NIE would need to employ personnel with non-R&D backgrounds to ensure favoring a policy of advocacy over one of "pure" experimental research. Backgrounds that are more likely to be appropriate are law, politics,

and community organization.

Summary

All the policies discussed above are grouped in Table 8 under three plans for organizing the R&D performer community. The policies have been selected in each plan to reinforce one another so that the combination of the policies produces plans that are maximally distinct and internally consistent.

Build R&D Resources. The first plan, which will be called the Build-R&D-Resources plan, uses the first policy for each of the first three choices outlined above and the non-advocacy policy for the fourth choice. The common theme among these policies is to improve the means for conducting educational R&D. These means include improving the quality of personnel performing educational R&D, the pattern of interactions among them, and the system of R&D institutions. The ultimate purpose of improving the means would be viewed as building a reservoir of knowledge, ideas, and products useful in improving education. NIE management would not be primarily and directly concerned with the exact substance of R&D on a project-by-project basis, but would focus instead on improving the infrastructure for conducting educational R&D in such ways that the resources available from the educational R&D community are more extensive and useful to others. The NIE would believe that the primary concern of R&D management should be personnel and institutional development rather than the particular problems solved and the R&D results obtained.

Of the existing agencies, this plan is followed partly by the National Institute of Dental Research and the National Institute of Child Health and Human Development in the National Institutes of Health, and more closely by the Department of Agriculture's Cooperative State Research Service, which manages the State Agricultural Experiment Stations.

Produce R&D Results. The second plan, which will be called the Produce-R&D-Results plan, uses the second policy for each of the first three choices discussed above and the non-advocacy policy

for the fourth choice. The common theme among these policies is an orderly approach to R&D management and organization where the NIE would, to a much greater extent than in the first plan, control the substance of R&D and be directly concerned with its effectiveness in producing results useful to educational policymakers and practitioners. This is an output-oriented plan compared to the first one, which is input-oriented. More precise division of tasks into subtasks would be made. To the maximum extent practicable, the progression of ideas from conception to implementation would be carefully orchestrated, with efficient allocation of resources a primary concern. Problems would be decomposed into requirements for knowledge, development, and reform, and resources would be allocated for "maximum" payoff. Evaluating the progress of R&D programs and redirecting effort toward more promising areas of study would be important management activities. Characteristic of this plan for organizing the R&D community, the NIE would take pride in its managerial competence.

This plan is followed most closely by some industrial R&D laboratories; in government it is used by the National Aeronautics and Space Administration's Goddard Space Flight Center.

Support Disciplined Change. The third plan for organizing the R&D performer community, which will be called the Support-Disciplined-Change plan, uses the third policy for each of the first three choices and the advocacy policy for the fourth choice. The common theme among these policies is that the NIE would integrate the educational R&D process with the more general educational change process--a change-oriented philosophy that is neither totally output-oriented nor totally input-oriented.

This plan would be viewed as a way of coping with the extreme complexity of educational phenomena and the difficult problems of educational goals, attitudes, and local circumstances. These difficulties would be considered greater in education than in many other fields, calling for different ways of organizing the R&D community. The plan would be considered a means of leap-frogging some of these difficulties--by relying more heavily on inventive

processes for educational advances and using R&D primarily as an evaluative check on and a guide for the inventive processes.

In our judgment, the Office of Child Development most closely follows this plan for organizing the R&D performer community.

ALTERNATIVE STRATEGIES FOR ORGANIZING AND MANAGING THE NIE

The five design elements just presented can be combined in a number of ways to generate alternative strategies for organizing and managing the NIE. Each strategy consists of a particular choice for each of these design elements:

- o A set of priorities among the R&D objectives,
- o A division of responsibility,
- o An organizational structure,
- o A management style for each major unit, and
- o A plan for organizing the R&D performer community.

Not all of the alternative strategies which can be generated, however, are compatible combinations of the elements. Many can be eliminated on reasonable grounds, leaving a limited number of combinations as attractive strategies for organizing and managing the NIE.

The determining factor in a combination of design elements is the *plan for organizing the R&D performer community*. Only certain combinations of the other design elements can be used with each of the plans.

Strategy I Based on the Build-R&D-Resources Plan

R&D Objectives. If NIE adopted the Build-R&D-Resources plan for organizing the R&D community, the objectives that would receive high priority would be fundamental research (Objective III), R&D manpower improvement (Objective VI), and institutional development (Objective VII). Objective III would be emphasized because the NIE would view fundamental research as a principal source of good ideas ultimately leading to improvements in education, while institutional

development and R&D manpower improvement (Objectives VI and VII) are directly responsive to the Build-R&D-Resources plan. The problem-solving objective (Objective I) would be strongly deemphasized on the grounds that the knowledge base in education is too weak for effective problem-solving activity. The policy studies objective (Objective V) would also be deemphasized since resource allocation, which is the purpose of policy studies, is not a main concern in this strategy.

Organizational Structure. The Build-R&D-Resources plan emphasizes improving and linking the R&D system more than concern for the substance of R&D. This priority implies that the NIE would have an extramural orientation and minimum control over program substance. The NIE would be very concerned with the establishment of coordinative linkages in the extramural community and less concerned with internal coordination of its own affairs. Consequently, the linked organizational structure would be more advantageous to use than the matrix structure: the linked organizational concept can be extended from a strictly internal application to provide a direct means of supporting extramural coordination (by selective collocation of extramural performers and utilization of the integrating unit staff), while the matrix structure cannot be easily extended beyond its use for internal coordination. The linear structure could also be used, but it would not provide the capability for bridging barriers among NIE's internal, organizational units that is provided by the integrating unit in the linked organizational structure.

Management Styles. The Build-R&D-Resources plan also implies using the less-directed management styles in all of the major organizational units. These management styles are more attractive to highly qualified R&D performers which are important in the plan, and would be thought to facilitate the generation of ideas, which is also important. The less-directed management styles also give less priority to the control of the substance of R&D.

Division of Responsibility. Of the two most attractive ways of dividing responsibility, organizing by R&D objective is probably more advantageous for the Build-R&D-Resources plan than organizing

by subject area. Dividing responsibility by R&D objectives produces an organization in which the major units are aligned with different categories of R&D performers (fundamental researchers, developers and evaluators, policy researchers, and so on), which allows each unit to maximize its attractiveness to a selected category of R&D performers. As previously mentioned, this is important in the Build-R&D-Resources plan. Dividing by subject areas would mean that each unit would have to support several R&D objectives, which would force each unit to attract R&D performers from several categories, To appeal to these several categories, compromises would have to be made in the selection of the professional background of unit leadership and in managerial policies, and this would tend to inhibit NIE's ability to compete with other R&D organizations for the most highly qualified R&D talent.

Strategy II Based on the Produce-R&D-Results-Plan

R&D Objectives. If the NIE adopted the Produce-R&D-Results plan for organizing the R&D community, the problem-solving objective (Objective I) would be emphasized, reflecting the plans' emphasis on managing R&D and producing usable R&D results. Another priority objective would be policy studies (Objective V). Policy studies would be emphasized as an aid in allocating R&D resources, an important aspect of this strategy. The objectives of manpower improvement and institutional development (Objectives VI and VII) would be deemphasized, reflecting the plan's deemphasis on infrastructure development.

Management Styles. The heavy emphasis on controlling program substance in the Produce-R&D-Results plan implies that the more directed management styles would be favored in most major units. The use of these management styles also supports the emphasis on problem-solving as an R&D objective. The urgency of the problem-solving objective probably requires an aggressive managerial approach.

Organizational Structure. Internal coordination of the NIE is essential with the Produce-R&D-Results plan, which suggests that either the linked or matrix organizational structures would be used.

Internal coordination is essential because in the more directed management styles used with the Produce-R&D-Results plan, more management functions are performed internally, requiring greater access to managerial and technical expertise. The matrix structure probably provides a more direct method of internal coordination, since access is provided directly through multiple assignments of work responsibility. Therefore, the matrix structure is preferred.

Division of Responsibility. Division of responsibility by R&D objectives probably offers the greatest advantages for the matrix structure for the reason discussed in the section entitled "Selecting an Organizational Structure." Both high differentiation and high integration are desirable in an organization, and division by R&D objective provides higher differentiation than division by subject area. Should a linear structure be used for some reason, dividing responsibility by subject area would be advisable to facilitate coordination among R&D objectives in supporting the problem-solving objective. With this arrangement, problem-solving would be conducted in most or all of the major units of organization.

Strategy III Based on the Support-Disciplined-Change Plan

R&D Objectives. If NIE adopted the Support-Disciplined-Change plan for organizing the R&D community, improving educational policies and practice (Objective II) would be emphasized. This would follow from the emphasis on achieving change in education through large-scale intervention activities with long-time perspective. The Support-Disciplined-Change plan does not imply that any of the R&D objectives would be strongly deemphasized.

Management Styles. The substantial involvement of practitioners and others in the R&D process and the incremental form of planning called for in the Support-Disciplined-Change plan rules out using the most directed management styles; management styles ranging from moderately directed to least directed would be most appropriate.

Division of Responsibility. Dividing responsibility by R&D objectives is probably best with the Support-Disciplined-Change plan for two reasons. First, the plan implies that large-scale educational

interventions would be emphasized as an R&D activity, and these large-scale interventions would tend to cut across the concerns of most conceivable subject-area divisions. If responsibility were divided by R&D objectives, these large-scale projects could be managed by one major unit under the objective to improve policies and practice (Objective II), greatly facilitating coordination.

A second reason for organizing by R&D objectives is that the intervention activity could be segregated into a major unit (or units) of the organization. Another major unit could be dedicated to short-range problem-solving, which would help to divert urgent tasks from the intervention activity and maintain its integrity. Still another major unit could be dedicated to conducting R&D in a more purely scientific way, partly to serve as an evaluative check on the intervention activity and partly to provide an independent source of knowledge and ideas for the intervention activity. Both of these factors are important parts of the Support-Disciplined-Change plan for organizing the R&D community.

Organizational Structure. If dividing responsibility by R&D objectives is adopted, the matrix or linked structures would probably be most useful in that extra capability for coordination is provided, but the Support-Disciplined-Change plan does not especially indicate a need for strong internal coordination of the NIE. If considerations other than those discussed in this report are important to the NIE managers, the linear structure could probably be used without contradicting the Support-Disciplined-Change plan.

Summary of the Three Strategies for the NIE

Three combinations of the basic design elements are summarized in Table 9. Each specifies the rudiments of an organizational and managerial strategy for the NIE.

At the level of discussion we have been using, these strategies for the NIE are still relatively abstract. A better understanding of the significance of each strategy can be gained by presenting concrete examples of how each could be implemented in a detailed organizational and managerial design. Designs for implementing these

Table 9

SUMMARY OF STRATEGIES FOR ORGANIZING AND MANAGING THE NIE

Strategies for Organizing and Managing the NIE	Strategy I	Strategy II	Strategy III
R&D Objectives emphasized	Fundamental research Manpower improvement Institutional development	Problem-solving Policy analysis	Improve practice
R&D objectives deemphasized	Problem-solving Policy analysis	Manpower improvement Institutional development	---
Division of responsibility	Division by R&D objectives	Division by R&D objectives	Division by R&D objectives
Organizational structure	Linear or linked	Matrix	Linked or matrix
Management style	Least directed	Most directed	Moderately to least directed
Plan for organizing the R&D community	Build R&D Resources	Produce R&D Results	Support Disciplined Change

basic strategies are developed in subsequent sections.

Format for Presenting the NIE Designs

Three designs (models) for implementing the strategies appear in Secs. III, IV, and V. Each design represents a different way of implementing one of the strategies.

The format for describing the NIE designs is as follows. Most of the details of organization and management have been arranged into tables; one table presents an overview of the entire design and more detailed tables represent each of the major units of organization in

greater detail. To clarify distinctions between the designs, numbers have been assigned to as many quantities as possible and the same format has been used for each of the different kinds of tables. The text describing a particular design will deal primarily with the features that distinguish it from the other designs.

The numbers assigned are based on the assumption of a $300 million total budget for extramural activities, which is a reasonable budget for the NIE to have in five to ten years time. No allowance will be made for overhead costs such as administrative services or costs for the NIE staff. The number of professional staff members in different positions will, however, be quoted so that an estimate of the management cost can be made by multiplying staff sizes by appropriate salary levels and overhead ratios.

III. NIE MODEL I: BUILD R&D RESOURCES

OVERVIEW

The first model for NIE is one way of implementing Strategy I, the strategy for organizing and managing the NIE based on the Build-R&D-Resources plan of organizing the R&D community. Many of the organizational and managerial techniques employed in the model that will be presented are used by the National Institutes of Health or the Department of Agriculture's Cooperative State Research Service, but others have been specifically designed to satisfy particular emphases in Strategy I.

As specified in the previous section, choosing the Build R&D Resources plan for organizing the R&D community implies the following choices of the other design elements:

1. Objectives: fundamental research, manpower improvement, and institutional development (Objectives III, VI, and VII) are emphasized; problem-solving and policy studies (Objectives I and V) are deemphasized.
2. Division of responsibility: By R&D objectives.
3. Organizational structure: Linear or linked.
4. Management styles: Least directed.

The principal question regarding this model is whether to use a linear or linked structure. The linked structure is probably preferable and will be used since it provides greater capacity for coordinating the R&D system, an important element of Strategy I.

An NIE model designed to implement Strategy I would probably have more of an external orientation* than the models implementing either of the other NIE strategies. The external orientation would be a result of using the least-directed management styles, which involve

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*One measure of an organization's external orientation is the number of external contacts that the organization's personnel have, expressed as a proportion of the total number of contacts the organization's personnel have both inside and outside the organization.

more interaction with the extramural community than the highly directed management styles.

The use of the less-directed management styles and the deemphasis on problem-solving and policy studies imply that the NIE would support less intramural research activity if it adopted Strategy I than if it adopted either of the other strategies. As discussed in Sec. I, less problem-solving activity means less need for intramural research activity--assuming that intramural research is not conducted for other reasons, such as demonstration of how an educational research facility should be managed or development of talent for other parts of the NIE.

OBJECTIVES

An allocation of the NIE's budget among the R&D objectives consistent with the first strategy would be about 10 percent for problem-solving (Objective I), 45 percent for practice-oriented R&D (Objective II),* 30 percent for fundamental research (Objective III), and 10 percent for manpower improvement (Objective VI); these percentages are shown in Fig. 5.

The emphasis in Strategy I on building a network of R&D institutions indicates that a substantial amount would probably be allocated to supporting a number of practice-oriented R&D centers located throughout the United States--*Education R&D Centers*.** These centers might reasonably receive 60 percent of the amount allocated to practice-oriented R&D (or 27 percent of the total NIE budget). With an average federal contribution of $4 million per center, a total of 22 Education R&D Centers could be supported. Each center could be targeted to a particular problem area of concern; or the NIE might decide to build a network of regional R&D centers, with each center serving a geographic region.

Of the amount allocated to fundamental research, approximately one-third (or 10 percent of the total NIE budget), would probably be used to support a number of fundamental research centers located across the country (which we will call *Education Science Centers*).

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*A "neutral" allocation of the NIE's budget to R&D objectives would be approximately 25 percent for problem-solving, 40 percent for practice-oriented R&D, 15 percent for fundamental research, 5 percent for manpower improvement, 10 percent for institutional development, and 5 percent for other uses. The relative emphasis given to the various R&D objectives can be measured by comparison to these values.

**Many of the existing Regional Educational Laboratories currently supported by the Office of Education could become Education R&D Centers.

At an average federal contribution of $3 million per center, a total of ten Education Science Centers* could be supported. Together, these Education R&D Centers and Science Centers would account for 40 percent of the NIE's total extramural budget, assuming the proportions suggested above are adopted.

Following the implication of Strategy I to concentrate on building a system of institutions as a primary educational R&D resource, the NIE would view these centers as the core of the nation's educational R&D system; thus, many of the NIE's activities would relate directly to the centers. For example, most of the support for manpower improvement (10 percent of the NIE budget) would be awarded to the centers as a means of further strengthening this core. By training R&D personnel in the centers, a substantial portion of the educational R&D community would, after a number of years of training, eventually have a strong familiarity with and allegiance to the centers. This would provide strong ties between the educational R&D community and the network of centers. Conducting training in the centers would also promote ongoing, interdisciplinary R&D activity and provide trainees with a good background with which to conduct research.

Activities

Strategy I implies an emphasis on certain kinds of R&D activities (see "Activities" in Fig. 5). In fundamental research, for example, longitudinal studies would probably be favored; establishing data bases would be considered essential for long-run success. Improvement of research methodologies and instrumentation would probably also be emphasized to provide a foundation for further research and development. In practice-oriented R&D, attention would be directed toward research more than with the other strategies (for example, inquiry into the characteristics of students, teachers, and subject matter, and the interactions among them). Large-scale social experimentation would be approached cautiously and not pressed unless rigorous designs could be completed. Problem-solving activities would be kept to a minimum, including only efforts to meet specific priority problems, respond to an Office of Education need,

*Many of the existing R&D centers currently supported by the Office of Education could become Education Science Centers.

or exploit a new research development. Broad-scale attacks on chronic deficiencies probably would not be undertaken in the belief that the existing knowledge base is inadequate.

The Performing Community

This model designed to implement Strategy I would probably have a larger proportion of the educational R&D performers associated with universities than the models designed to implement the other strategies. This would result partly because there is an emphasis on fundamental research and partly because, with the emphasis on technical quality, practice-oriented R&D would tend to be performed by university personnel. With Strategy I, the NIE managers would probably believe that the highest quality R&D talent is found in the universities. The best performers from all the disciplines would be vigorously recruited into all educational R&D activities.

If the NIE followed Strategy I, problem-solving would probably be performed and in large part managed by personnel from the Education Science Centers and Education R&D Centers. Center staff would plan problem-solving activities and perform most of the projects. The NIE staff's role would be limited to organizing the planning activity, selecting projects, and coordinating the project performance.

As part of an institution supported by a block grant and not bound to specific project contracts, the center staff could set aside their long-term work more conveniently than most R&D performers, and periodically take on urgent tasks such as problem-solving. The center staff would be experienced in working together, and would have special knowledge pertaining to their locales that would be helpful in finding practical solutions to problems. Drawing on the center staffs to plan and execute priority problem-solving efforts would be a major strength of Model I for the NIE; this illustrates very clearly the R&D resource orientation of Strategy I.

The emphases of Strategy I imply that the NIE would build its system of centers very slowly--only as rapidly as well-qualified center directors and staff could be assembled. No more than one or two centers would probably be established within a single year. A cautious approach, with

quality a greater concern than action, would be characteristic of NIE center planning, and indeed, this approach would apply to most of the NIE's management activities.

DIVISION OF RESPONSIBILITY

Strategy I specifies dividing responsibility by R&D objectives and applying a linked structure, but it does not imply a specific assignment of R&D objectives to the major organizational units. This ambiguity will be resolved by making a number of choices that will be guided by our understanding of Strategy I. Together with the factors that have just been discussed, these choices and others to be made subsequently will determine Model I for the NIE. We have divided responsibilities among four major units of organization.

Fundamental research activities (Objective III), including the management of Education Science Centers, could be assigned to one major unit, which we will call the *Fundamental Research Division*, to facilitate coordination of what are substantively indistinguishable activities. For the same reason, practice-oriented R&D activities (Objective II) and Education R&D Centers could be grouped into a second major unit, which we will call the *Education R&D Division*. Although the size of the Education R&D Division in total budget dollars would be almost twice the total budget of the Fundamental Research Division, the staffs of these two divisions would be approximately equal in size.* The staff of the Education R&D Division would be smaller in relation to the division's total budget than the staff of Fundamental Research Division, because a larger proportion of the budget for the Education R&D Division is allocated to supporting the R&D centers, and part of the responsibility for managing these centers (in particular, program evaluation) can be assigned to another NIE division.

Problem-solving activities (Objective I) could also be added to the Education R&D Division as a means of coordinating the dual use of the Education R&D Centers for practice-oriented R&D and for problem-solving. Combining practice-oriented R&D and problem-solving in the Education R&D Division does not raise the staff

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*Large disparities in the staff and budget sizes of the divisions of an organization are assumed to be managerially undesirable.

requirements for the division substantially, because most of the staff work for problem-solving is contributed by the centers, and because problem-solving would not receive a large share of the NIE's resources. The total staff sizes of the Education R&D Division and the Fundamental Research Division are shown in Fig. 5.

The third major unit could be the integrating unit defined in the linked organizational structure, which we will call the *Program Integration and Coordination Division.* The short-run problem-analysis activities included under the policy studies objective (Objective V) could be included in this unit. The long-run policy-analysis activities under Objective V could be assigned to a fourth major unit called the *Policy Studies Group.* (A discussion of the different kinds of activities uncluded under that objective is presented on pp. 6-7.)

The Program Integration Division could also be assigned responsibility for managing the evaluation of all NIE activities. Assigning evaluation responsibility to a different organizational unit than the ones responsible for program management would provide "checks and balances" in the program management process. By utilizing panels of R&D peers and practitioners to conduct these evaluations, the role of external communities in influencing R&D activities is strengthened in relation to NIE management. This role would be consistent with the emphasis of Strategy I on building linkages throughout the educational R&D system.

The Program Integration Division could also consult with NIE program managers and center staff to help resolve organizational and managerial problems and encourage organizational development. Again, this responsibility would be consistent with the emphases of Strategy I.

ORGANIZATIONAL STRUCTURE

Other choices that must be made involve the organizational structure of the NIE. The two coordinating mechanisms in the linked structure (the integrating unit and collocation)* could be used in several ways that would be consistent with Strategy I:

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*See pp. 14 and 16-19 for a discussion of the linked structure.

- o The Education Science Centers could be located at the best universities as a means of drawing on the most capable research personnel in the disciplines.
- o Some key working groups from the Education R&D Centers could be collocated with Education Science Centers to help bridge the gap between fundamental research and practice-oriented research. Some of the Education R&D Centers might even be collocated with Science Centers in cases where an especially strong linkage is needed.
- o The Education R&D Centers could be given incentives to obtain other local or state sources of financial support. This would help bind the Education R&D Centers into a close working relationship with practitioners and the education community.
- o The Program Integration Division could place one staff member in each center to help with center planning as a means of communicating between the NIE headquarters and the centers.
- o The Program Integration Division could provide planning experts to programs in the Education R&D Division as a means of coordinating the NIE internally.
- o Some of the Policy Studies Group could have a joint appointment with the Program Integration Division to help maintain a mutual linkage between these two units.

These choices are indicated in Fig. 5 and Tables 10 through 13.

Internal Structure

The internal structures of the Fundamental Research Division and the Education R&D Division could be essentially linear, with perhaps four levels of management in each division to accommodate the workload.

Responsibilities could be divided within these divisions in any appropriate way; for example, by scientific discipline in the Fundamental Research Division and by subject matter in the Education R&D Division. For maximum advantage, responsibilities within the Program Integration Division could be divided in three ways: by school-age group for the evaluation functions of the division, by the organizational unit assisted (centers or NIE programs) for the planning assistance functions of the division, and by function (organizational

development or information systems) for the remaining functions of the division (see Table 12). Dividing by age group for the evaluation function enables each unit responsible for evaluation to direct its attention toward a cross section of activities in the other divisions (Fundamental Research and Education R&D), assuming that neither of these divisions are divided by age group. The planning assistance functions cannot be divided among these same age-group units responsible for evaluation, since the planning assistance staffs performing these functions are located with and work for the NIE programs and centers, most of which would not be concerned with a particular age-group population. The remaining duties of the Program Integration Division could be organized by function to create the framework needed to perform effectively.

Staffing Plan

Reasonable staffing plans for the divisions of an NIE following Strategy I appear in Tables 10 through 13. The basic management units in these plans are teams consisting of one Program Director and four or five Associate Program Directors, who would have primary authority for all the R&D in an assigned problem area and a budget of approximately $6 million.

In the Fundamental Research Division, program planning would be done by these teams for their own programs with coordination provided by a division deputy for planning. In the Education R&D Division, planning also would be done by the teams, but extra staff would be available (some provided by the Program Integration Division) to increase the level of planning activities and hence, management control. Additional management control is needed to avoid the tendency for practice-oriented R&D to fragment into a large number of unrelated projects. In fundamental research, the research peer groups are generally more effective, which tends to strengthen R&D activities and eliminate the need for management control to reduce fragmentation.

The staffing plans in Tables 10 through 13 have been designed to provide approximately one professional manager for every $1 million spent on extramural projects. (These managers would also have center management responsibilities.) Based on the experience of government R&D agencies, this is a minimum amount for achieving the style of

management to be employed.

In the style of a linked organizational structure, the pay structures in the Education R&D Division, the Fundamental Research Division, and the Program Integration Division should be equal so that one division does not tend to dominate the other.

To aid in attracting high-quality R&D performers into educational R&D, a large proportion of the managers should probably have direct experience in research or development. The specified backgrounds for the positions in the staffing plans are indicated in Tables 10 through 13. For example, three of the four division directors could have a background in R&D; the other director could have a background in management. This emphasis on personnel with R&D backgrounds would strongly shape the NIE's organizational character.

MANAGEMENT STYLES

Following the specifications in Strategy I to employ the less-directed management styles, a reasonable selection would be to choose the interventionist style for managing both fundamental research and practice-oriented R&D. The level of management control over program content should, however, be somewhat higher in the Education R&D Division for reasons discussed above. This can be achieved through the greater allocation of staff to planning and the dissemination of R&D objectives to the performing community.

The centers could be managed with a decentralized style. The same program managers responsible for managing extramural R&D projects could also manage the centers.

Problem-solving activities could be managed according to a less-directed form of the directive management style. Ideas for programs could come as requests from the Office of Education, from center directors in the Policy Studies Group, from analyses conducted by the Program Integration Division, or from the managers of the Education R&D Division. Program ideas could be assembled by the Director of Program Planning and Analysis in the Office of the Director and then analyzed to assess their relative importance and solvability. The Director of the NIE could then select the top-priority problems and assign them to the to the Education R&D Division. A small staff of two or three NIE managers could then work with staff members from the centers to plan

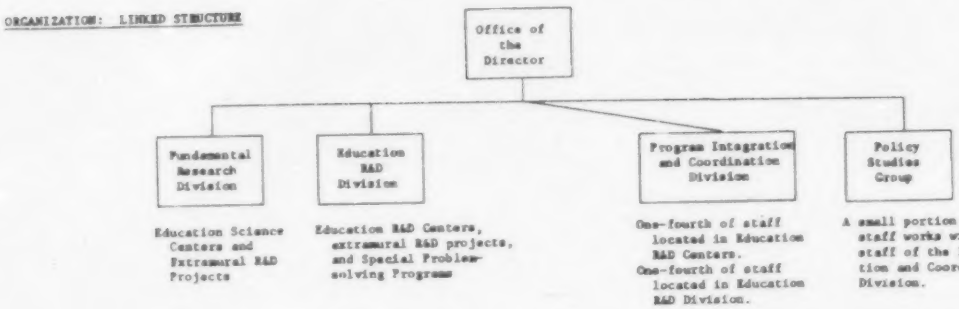
and execute each assigned program. Cooperation among the centers in planning these programs could be encouraged by not determining the budget levels for a program until detailed plans had been prepared. Well planned programs would receive more funds.

The management plan we have chosen for implementing Strategy I is described in detail in Tables 10 and 11.

The program activities of the Fundamental Research Division and the Education R&D Division could be evaluated by peer-group panels as described at the bottom of Table 12. For fundamental research, the panels could be exclusively researchers, but for practice-oriented R&D, practitioners and public figures could be appointed to serve with R&D performers. These panels could be managed by Age-Group Unit staff.

Subsequent sections will describe models for implementing Strategy II and Strategy III.

Fig. 5--Model I: Build R&D Resources


ORGANIZATION: LINKED STRUCTURE
Office of the Director
Fundamental Research Division
Education R&D Division
Program Integration and Coordination Division
Policy Studies Group
Education Science Centers and Extramural R&D Projects
Education R&D Centers, extramural R&D projects, and Special Problem-solving Programs
One-fourth of staff located in Education R&D Centers.
One-fourth of staff located in Education R&D Division.
A small portion of the staff works with the staff of the Integration and Coordination Division.

ACTIVITIES	Sponsor extramural research in the education sciences. Support centers in the education sciences.	Sponsor extramural practice-oriented R&D. Support practice-oriented R&D centers. Manage programs to solve important national problems.	Influence formation of national education policy. Allocate R&D resources to divisions. Select national problems to solve. Perform other administrative support functions.	Manage the evaluation of all NIE programs. Provide organizational development consultation to R&D centers and NIE divisions. Assist centers in planning their R&D activities. Assist R&D division in planning its programs. Conduct problem analyses.	Conduct policy studies. Conduct intramural research. Provide subject matter expertise to other NIE divisions. Propose national problems to be solved by directed effort.	

	Percent of NIE Budget Expended on Extramural Activities					Total
OBJECTIVES						
Problem-solving	--	10%	--	--	--	10%
Practice-oriented R&D	--	20%	--	--	--	20% (45%)*
Fundamental research	20%	--	--	--	--	20% (30%)*
Linkage to practice	--	--	--	5%**	--	5%
Manpower improvement	5%	5%	--	--	--	10%
Institutional development	10%	25%	--	--	--	35%
Total	33%	60%	0%	5%	0%	100%
DIVISION STAFF, PROFESSIONAL†						
Intramural research	--	--	--	10††	100	110
Extramural management	102	140	11	83	--	336
Total	102	140	11	93	100	446
MANAGEMENT STYLE	Fundamental: interventionist Centers: decentralized	Practice R&D: modified interventionist Problem-solving: modified directed Centers: decentralized	--	--	Informally managed	

*Figures in parentheses include institutional development.

**The division would support a data-collection network as an aid in problem analysis.

†Based on a total extramural budget of $300 million.

††Joint appointment with Policy Studies Group.

Table 10

DETAILED PLAN FOR THE FUNDAMENTAL RESEARCH DIVISION

ORGANIZATIONAL STRUCTURE

The Fundamental Research Division would consist of four sections. Each section would have four programs. Sections would support several Education Science Centers.

	Extramural R&D Projects	Education Science Centers
ACTIVITIES	All activities under Objective III would be strongly supported: philosophical, historical, and experimental inquiry into basic educational phenomena. Longitudinal studies and research on improved methodology and instrumentation would be stressed.	Center activities would be the same as those conducted in Extramural Research Projects. Most of the training of fundamental research personnel would be done in the centers.
PERFORMING COMMUNITY	Multiyear grants would be given to individual investigators and occasionally to multidisciplinary teams. Almost all investigators would be located in universities.	Each center would receive a biannual block grant to conduct research in a designated research area. Each center would be collocated with a university. The center director would report to the university Vice-President for Research or his equivalent, not the Dean of the School of Education. Some personnel from practice-oriented R&D centers would be collocated in the Education Science Centers to facilitate coordination.

STAFFING PLAN

Division Director, Fundamental Research
Salary: GS-18 equivalent.
Recognized for accomplishments in fundamental research.

Determine each section's budget for programs.	Determine the budget level for each center.
Deputy Division Director, Extramural Planning Salary: GS-16 equivalent. Organizes development of important new research areas.	**Deputy Division Director, Center Planning** Salary: GS-16 equivalent. Develops policies for managing centers. Organizes development of new centers.

Section Director
Salary: GS-17 equivalent.
Total of four directors in the division.
Background in fundamental research.

Allocates section budget ($35 million) to programs in consultation with the Program Integration Division.	Recommends priorities for centers in consultation with the Program Integration Division and the Deputy for Center Planning.

Program Director
Salary: GS-15 equivalent.
Total of 16 directors in the division.
Background in research and/or research management.
Manages a team of approximately five Associate Program Directors.

Associate Program Directors
Salary: GS-13 equivalent.
Total of 80 directors in the division.
Sizeable portion on tour-of-duty appointment status.

Manages research activity in assigned subject area. Areas overlap to facilitate communication and flexibility.	Reviews center projects in assigned area. Exercises limited power to veto low-quality projects.

Table 10 (Continued)

MANAGEMENT PLAN	Program Planning A statement of research priorities, especially new initiatives needed, would be prepared annually by the Deputy for Extramural Planning. Associate Program Directors would implement the plan by recruiting researchers in priority areas. Many workshops and conferences would be sponsored to attract researchers into priority areas and strengthen the peer-group communities. Program Directors and Associate Program Directors would travel extensively in the research community to keep abreast of technical progress, stimulate interest in priority areas, and recruit high-quality performers. Program Development Project Generation. Project ideas would be generated by individual researchers and submitted for funding. Project Selection. All proposals with a chance for funding would be sent to mail reviewers for technical evaluations. Associate Program Directors would determine the list of projects to be supported in their area in consultation with other Associate Program Directors and the Program Director. Project Monitoring. Workshops for researchers within a field would be sponsored to stimulate mutually beneficial interaction and exchange of information. Program Evaluation A panel of scientific peers would convene annually to review each program. These panels would be convened and chaired by the Program Integration Division. State-of-the-art reviews would be conducted periodically within the programs.	Program Planning Each center would do its own program planning. A resident staff planner would be provided for each center by the Program Integration Division. A statement of research priorities would be prepared annually for the Division Director by the Deputy for Center Planning. The Deputy would work with center planning staffs and others in preparing these plans. Program Development Project Generation. Centers would generate and select their own research projects. Associate Program Directors would briefly review all projects approved by the centers in their assigned research area and veto excessively poor-quality or low-priority projects. These judgments would be supported by mail review. Project Monitoring. Center researchers would be heavily involved in the conference and workshop activities organized within the programs. Program Evaluation Each center would be rigorously evaluated bi-annually by the Program Integration Division. The division would utilize panels of scientific peers and management experts. These evaluations would be used by the Division Director in determining center budgets.

Table 11

DETAILED PLAN FOR THE EDUCATION R&D DIVISION

ORGANIZATIONAL STRUCTURE

The Education R&D Division would consist of five sections. Each section would have four programs (on the average). Programs would support extramural research projects. Sections would support (on the average) four Education R&D Centers.* For coordination, each R&D center would collocate some personnel with an Education Science Center, and/or with other R&D centers.

ACTIVITIES

Extramural R&D Projects

R&D on improved methodology and research into the characteristics of learners, teachers, and subject matter would be the R&D activities emphasized (Objective II).

Special Problem-solving Programs

Problem-solving efforts would be limited to Office of Education priority needs; specific, urgent national problems; and exploitation of research breakthroughs (Objective I). Most programs would consist of a single round of projects rather than continuing sequence of multiple projects lasting over many years.

PERFORMING COMMUNITY

Multiyear grants would be awarded to individuals and to small teams.
Approximately one-half of the performers would be from universities. The remainder would be in private R&D firms and education agencies.
Researchers would frequently be matched with practitioners on development projects.

Most of the projects in directed programs would be planned and performed by teams of investigators and developers from Education Science Centers and Education R&D Centers.

STAFFING PLAN

Division Director, Education R&D
Salary: GS-18 equivalent.
Recognized for accomplishments in education research and/or development.

Determine each section's budget for programs.
Determine each center's budget (biannually).*

Responsible for the problem-solving tasks assigned to the division by the NIE Director.

Deputy Division Director, Extramural Planning**
Salary: GS-16 equivalent
Organizes development of important new R&D areas.

Deputy Division Director, Special Programs
Salary: GS-16 equivalent.
Coordinates problem-solving efforts.
Experienced in program management.
Selects the Program Managers.

Section Director
Salary: GS-17 equivalent.
Total of four directors in the division.
Allocates section budget ($25 million) to programs in consultation with the Program Integration Division.

Program Managers
Salary: GS-15 equivalent.
One manager per program.
Successful performance as Associate Program Director.
The Program Managers' positions would be viewed as a promotion for Associate Program Directors.

Program Directors
Salary: GS-16 equivalent.
Total of 16 directors in the division.
Background in research and research management.
Manages team of six Associate Program Directors. Responsible for R&D activity in an exclusive, assigned research area.

Program Staff
Salary: GS-14 or less.
One or two staff members per program.
Assists Program Manager.

Associate Program Directors
Salary: GS-15.
Total of 80 directors in the division.
Manages R&D activity in an assigned subject area. Areas assigned overlap to facilitate interaction.
Many Associate Program Directors on rotating assignment from universities.

Planning Staff
Salary: GS-13 to GS-14.
One or two staff members per program.
One staff member employed by the Program Integration Division.
Background in resource allocation analysis.
Reports to Deputy for Extramural Planning.

NOTES: *Nondirected R&D activity constituting the bulk of center activity would be managed in the same way as the Education Science Centers in the Fundamental Research Division.

**There would also be a Deputy Division Director, Center Planning with the same responsibilities as the Deputy for Center Planning of the Fundamental Research Division.

Table 11 (Continued)

MANAGEMENT PLAN		
	Program Planning A statement of research priorities, especially new initiatives needed, would be prepared annually by the planning staffs of each program. This effort would be monitored and coordinated throughout the division by the Deputy for Extramural Planning. Associate Program Directors would implement the plan by recruiting researchers and developers in priority areas. Many workshops and conferences would be sponsored to attract R&D performers into priority areas and strengthen the peer-group communities. Program Directors and Associate Program Directors would travel extensively in the R&D community and the practitioner community to keep abreast of technical progress and stimulate interest in priority areas. **Program Development** Project Generation. Project ideas would be generated by individual R&D performers and submitted for funding. Project Selection. All proposals with a chance for funding would be sent to mail reviewers for technical evaluation. Associate Program Directors would determine the the list of projects to be supported in their area in consultation with other Associate Program Directors and the Program Director. Project Monitoring. Workshops for R&D performers in a field would be sponsored to stimulate mutually beneficial interaction and exchange of information. Project Utilization. Each R&D center would be linked to a network of extension agents. Project results would be made available to this network. **Program Evaluation** A panel of R&D performers and practitioners would be convened annually to review each program. These panels would be convened and chaired by the Program Integration Division. State-of-the-art reviews and problem-assessment workshops would be conducted periodically within the programs.	**Program Planning** Programs would be assigned to the division by the NIE Director. Some programs would be generated within the division but would have to be approved by the Director. When assigned, the programs would be planned in a general way. The Division Director would select a Program Manager to head each problem-solving assignment. The Program Manager would run a number of planning workshops in the first few months of a program to generate a set of program priorities and project ideas. These workshops would be attended mostly by performers from the Education Science Centers and the R&D Centers. The first round of workshops would assess the state-of-the-art and tentative priorities for program content. A second round of workshops would be held to further discuss priorities and hear proposals for projects. **Program Development** Project Generation. The Program Manager would request the centers to submit two priority lists: the most important R&D tasks from a national perspective, and the tasks the center would be most able and willing to undertake. Project Selection. Based on each center's contribution to the workshops and the submitted lists, the Program Manager would select a number of centers to participate further in the program. The Directors of these centers would be invited to a session where the lists of priorities would be compared to determine common areas of concern. A program coordinator from the Program Integration Division would participate in this meeting. The Directors would then be asked to select the best set of projects for three different budget levels. The Division Director could then determine the budget for each program based on the quality of the plans. The Director would consult with the Program Integration Division. The Program Manager would then allocate the budget to projects. Project Monitoring. The Program Manager would coordinate all projects by conducting site visits and workshops. Project Utilization. Some programs would include implementation activities. Otherwise, results would be distributed through the extension network (see "Project Utilization" in the adjacent column). **Program Evaluation** With only one round of projects, programs would not be evaluated.

Table 12

DETAILED PLAN FOR THE PROGRAM INTEGRATION AND COORDINATION DIVISION

ORGANIZATIONAL STRUCTURE

The division consists of three Age-Group Units, an Organizational Development Unit, and an Information Systems Unit. The three Age-Group Units are the Early Childhood Unit, the Adolescent Ages Unit, and the Adult Ages Unit.

ACTIVITIES

Age-Group Units	Organizational Development Unit	Information Systems Unit
Identification of priority problems through (1) a network of staff located in the Education Science Centers and Education R&D Centers, (2) analysis of data collected through an Information System Unit, and (3) contacts with the Policy Studies Group. Organization and coordination of efforts in the other NIE divisions to solve these problems. Management of the evaluations of all NIE programs and centers. Implementation of the results of these evaluations by (1) influencing the planning process in each program and center, and (2) by influencing the NIE managers at the section and division levels.	Assistance to programs and centers in solving organizational and management problems. Coordination of policy developed for the centers by the Deputy Division Directors for Center Planning.	Development, installation, and operation of information systems for collecting data useful to the NIE planners, managers, and policy analysts. Analysis of the information collected.

STAFFING PLAN

Division Director, Program Integration and Coordination
- Salary: GS-13 equivalent.
- Strong background in R&D management.
- Brings education problems and program evaluation results to the NIE Management Council (the Division Directors, Policy Studies Director, and the NIE Director).

Assistant Division Director, Age-Group Units
- Salary: GS-17 equivalent.
- Total of 3 in the division.
- Experience in managing educational change and R&D.

Age Group Units Staff
- Salary: GS-14 to GS-16.
- Total of 12 staff per unit. Some on joint appointment with Policy Studies Group.
- Sited with Program Integration Division.
- High interpersonal competence in dealing with all segments of the R&D community.
- Responsible for managing the evaluation of those programs and centers most closely related to the staff's Age-Group Unit category.
- Responsible for implementing the results of these evaluations by working with planning staff, Program Directors, and Section Directors.
- Responsible for identifying problems and organizing NIE efforts to solve them.

Review Panels
- Salary: Per diem plus travel expenses.
- Total of 50 review panels, 1 or 2 per program.
- Recognized for accomplishments in research, educational practice, or be a public figure.
- Three-year term of service for each panelist.
- Involved in evaluating R&D activities of the divisions.

Executive Assistants
- Salary: GS-11 to GS-12.
- Total of 25 in the division.
- Responsible for handling business affairs of the review panels.

Deputy Division Director, Planning Staff
- Salary: GS-16 equivalent.
- Background in R&D planning.
- Manages planning staff.

Planning Staff
- Salary: GS-13 to GS-15.
- Total of 20 positions in the division, 1 per program.
- Sited with the Education R&D Division (as program planners).
- Background in resource allocation analysis and organizing projects.
- Rotated to a new position at least every 3 years.

Deputy Division Director, Center Planning Staff
- Salary: GS-16 equivalent.
- Background in R&D planning.
- Manages planning staff provided to the centers by the division.
- Reports to Division Director.

Center Planning Staff
- Salary: GS-13 to GS-14.
- Total of 20 positions in the division, 1 per center.
- Sited with Education R&D Centers.
- Background in resource allocation, analysis and project organization.

Assistant Division Director, Organizational Development
- Salary: GS-17 equivalent.
- Experience in improving organizations.

Organizational Development Staff
- Salary: GS-13 to GS-16.
- Total of four on the staff.
- Assist centers in solving organizational and managerial problems.
- Assist other NIE divisions with organizational and managerial problems.

Assistant Division Director, Information Systems
- Salary: GS-17 equivalent.
- Background in policy analysis.

Information Systems Staff
- Salary: GS-13 to GS-16.
- Total of six members on the staff.
- Some on joint appointment with Policy Studies Group.
- Manage data collection network.
- Analyze collected data to isolate problems (in cooperation with Policy Studies Group.

Table 13

DETAILED PLAN FOR THE OFFICE OF THE DIRECTOR AND THE POLICY STUDIES GROUP

ORGANIZATIONAL STRUCTURE	The Office of the Director would have only one unit concerned with program substance, a Program Planning and Analysis Unit. Other units would be necessary for administrative services. The Policy Studies Group would report to the Office of the Director and have stature equal to the Education R&D Division and Fundamental Research Division. The internal structure of the Policy Studies Group would be determined by the Policy Studies Group Director.	
	Office of the Director	Policy Studies Group
ACTIVITIES	Assemble a list of tentative programs suggested by the NIE divisions for solving important national problems. Assess the relative priority and solvability of these program suggestions. Prepare annual budget plans.	Assist the NIE Director in advising HEW on the implications of R&D for educational policy. Prepare studies of the state of American education. Generate ideas for new NIE programs, particularly problem-solving efforts. Offer technical assistance to the Program Integration Division on program planning and evaluation.
STAFFING PLAN	Director, NIE Salary: Executive Level V. Appointed by the President, confirmed by the Senate. Deputy Director, NIE Salary: GS-18 equivalent. Director, Program Planning and Analysis Salary: GS-17 equivalent. Background in program budgeting analysis. Program Planning and Analysis Staff Salary: GS-13 to GS-16. Total of eight members on the staff. Some would have a background in planning R&D in the centers. Some would have background in research, although it would be limited.	Policy Studies Director Salary: GS-17 equivalent. Background in research and policy analysis. Policy Studies Staff Salary: GS-12 to GS-16. Approximately 100 professionals would be on the staff. No formal staffing plan is recommended. Many of the staff would be preeminent scholars on 1- or 2-year fellowships.

IV. NIE MODEL II: PRODUCE R&D RESULTS

OVERVIEW

The second model for the NIE implements Strategy II, the strategy based on the Produce-R&D-Results plan of organizing the R&D performer community. Many of the organizational and managerial techniques employed in this model are used by the National Cancer Institute or the National Aeronautics and Space Administration's Goddard Space Flight Center, but others have been specially designed to satisfy particular emphases in Strategy II.

As specified in the previous section, choosing the Produce-R&D-Results plan for organizing the R&D community implies the following choices of the other design elements:

1. Objectives: problem-solving and policy studies (Objectives I and V) are emphasized; manpower improvement and institutional development (Objectives VI and VII) are deemphasized.
2. Division of responsibility: By R&D objectives.
3. Organizational structure: Matrix.
4. Management styles: Most directed.

As a result of two factors--employing the most directed management styles and the deemphasis on building a network of R&D institutions--the NIE would probably have much greater internal orientation than would probably occur with either of the other NIE strategies. Using the most directed management styles would tend to increase the NIE's internal orientation because in these styles most decisions are made by internal staff in consultation with other internal staff. The deemphasis on building a network of R&D institutions also tends to increase the NIE's internal orientation, since this objective inherently involves frequent contacts with persons outside the NIE.

A consequence of emphasizing problem-solving is that there would be more intramural research than with any of the other NIE models.*

The internal orientation and the large intramural program would not necessarily imply that most of the NIE's resources would be spent on internal projects and management staff. On the contrary, over 85 percent of the NIE's total budget would still be awarded extramurally.

OBJECTIVES

A reasonable distribution of the NIE's budget among the R&D objectives consistent with the second strategy would be approximately 50 percent for problem-solving (Objective I), 30 percent for practice-oriented R&D (Objective II), 12 percent for fundamental research (Objective III), and 3 percent for manpower improvement (Objective VI). These proportions, modified slightly to allow for other specific NIE activities, are shown in Fig. 6.

The deemphasis in Strategy II on building a network of R&D institutions indicates that less than 10 percent of the NIE's budget would probably be allocated to direct support of R&D centers; of the total NIE budget allocated to practice-oriented R&D, 10 percent (or 3 percent of the total NIE budget) might reasonably be allocated to direct support of practice-oriented R&D centers located throughout the country. Of the total NIE budget allocated to fundamental research, 17 percent (or 2 percent of the total NIE budget) might reasonably be allocated to the support of fundamental research centers located across the country.

The form of this institutional support would probably be different than in the first NIE model. Instead of a large grant to cover both institutional costs and R&D projects, a grant to cover institutional costs--a core grant--would probably be provided.

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*See p. 25 for a discussion of why the availability of intramural researchers is essential in conducting problem-solving activity.

R&D institutions receiving core grants would have to compete for R&D projects just as other R&D organizations not receiving core grants. The NIE would not be very concerned with the substance of projects conducted by the institutions receiving core grants, preferring instead to rely on competition for projects as the primary guidance mechanism. The NIE would have substantial control over the content of these projects and, thus, because of the competition among R&D institutions receiving core grants and others competing for the NIE's awards, over the programs of the R&D institutions.

One result of the core grant system would be that the NIE could support a larger number of R&D institutions per dollar of institutional aid. Even with the low percentage of NIE resources dedicated to institutional development in this strategy (5 percent), about the same number of R&D institutions would probably be supported as in the first NIE model.

Consistent with the emphasis in Strategy II on internal management control, most of the resources for training R&D personnel would probably be directed by the Program Managers responsible for fundamental research and practice-oriented R&D to problem areas where the needs for higher quality R&D manpower are greatest. Most of these training projects would probably be located in universities as a means of attracting the most able of the student population into educational R&D.

Activities

The Model II strategy for the NIE implies an emphasis on certain R&D activities (See "Activities" in Fig. 6). The strategy's emphasis on a managerial approach to educational R&D and on the efficacy of utilizing existing capabilities to solve problems suggests that within the problem-solving objective broad-scale attacks on chronic educational problems (see activities included in Objective I) would probably be emphasized. The NIE would probably assume the responsibility for these efforts from initial formulation well into the implementation stages of activity so that viable solutions would be assured. At some point, however, implementation responsibility would

probably be transferred to another agency and the program terminated, since the NIE would probably not command the resources necessary for nationwide implementation. Most of these efforts directed toward solving chronic problems would probably receive a substantial portion of the NIE's total resources when the transfer occurred. Other important problem-solving activities would probably include responses to Office of Education needs and solving priority problems. Activities emphasized in fundamental research would include investigations to determine the goals of education as an aid in answering questions, such as where R&D resources should be allocated and how educational improvements should be designed. Activities under the practice-oriented R&D objective would probably center on educational development, involving the production of educational products useful in the schools. Large-scale experiments would probably be conducted, but in most cases as part of a problem-solving effort under Objective I rather than as part of a practice-oriented R&D activity (Objective II). As a consequence of the short time perspective of activities under Objective I, experiments in Strategy II would more often be a single project or a single round of several projects conducted simultaneously as opposed to Strategy III, which emphasizes conducting cumulative sequences of experiments, each sequence requiring a long period of time to reach maturity and completeness.

Performing Community

A larger proportion of the R&D performer community would probably be located in nonuniversity research institutes and R&D organizations in Strategy II than in the other strategies because of the emphasis on problem-solving and the general orientation of responding to NIE requests. Neither university personnel nor educational agencies are as capable of responding to a managerial environment that demands rapid and flexible responses.

Another characteristic of the performer community would probably be a greater degree of homogeneity. Subcommunities of R&D performers would be less identifiable because of the pressures for multidisciplinary teamwork on problem-solving activities and the lack of

direct managerial action to strengthen peer communities. Management would be more concerned with finding the right performer for a job than with strengthening performance in various areas of research.

DIVISION OF RESPONSIBILITY

The second strategy specifies dividing responsibility by R&D objectives and utilizing a matrix structure, but further specification is needed to more fully understand which parts of an organization adopting Strategy II would perform which responsibilities. For Model II, this issue will be resolved by making a number of choices guided by our understanding of Strategy II. Together with the factors that have just been discussed, these choices and others to be made subsequently will determine Model II for NIE. The resulting plan, shown in Fig. 6, is very similar in form to Rand's initial design for the NIE,* although much more detailed and specific.

The NIE's responsibilities could be divided among four major units of organization. One major unit could be the *Directorate of Programs*, which would be responsible for the NIE's problem-solving objective. This directorate could be one dimension of the matrix organizational structure specified by the second strategy. Thus, programs in the directorate would draw on the other NIE directorates for most of their staff. This directorate would be the temporary dimension needed in a matrix organization,** since each of the problem-solving efforts in the directorate would have a finite lifetime.

The second major NIE organizational unit could be the *Directorate of Administration and Management*. The other NIE models would have an administrative services unit but, reflecting the lessor importance

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*Levien, R. E., *National Institute of Education: Preliminary Plan for the Proposed Institute*, The Rand Corporation, R-657-HEW, February 1971.

**See p. 20 for a discussion of the dimensions of the matrix organizational structure.

of management control in the strategies on which these models are based, administrative services could be provided by a unit in the Office of the Director. Expert provision of administrative services is critical to any R&D organization, a point that is hard to overemphasize, but in this second model for the NIE, the administrative arm could assume much greater influence over the substance of R&D by being designated as a directorate, equal in stature to the other directorates. This directorate could provide the usual management services (such as personnel, accounting, and so on). Three other responsibilities could be assumed by the Directorate of Administration and Management, indicating its importance within the NIE: (1) organize internal reviews of all NIE programs, (2) build and operate an information system to aid the other divisions in problem analysis, and (3) analyze manpower utilization within the NIE. The manpower analysis function would be important because of the tendency for the matrix organizational structure to revert to a linear structure over the long run.* The manpower analysis function would be to monitor the pattern of personnel assignments within the NIE to detect this tendency at an early stage. Direct managerial action would then be taken to restore the proper balance of personnel assignments within the NIE.

The objectives of fundamental research, practice-oriented R&D, institution-building, and manpower improvement could be assigned to a third major unit called the *Directorate of Education R&D*. The purpose of this directorate would be to produce knowledge, products, and manpower intrinsically useful in meeting educational needs, but also useful as resources for future problem-solving efforts. Thus, the directorate's activities would be considered an investment in future problem-solving capability as well as a source of directly implementable results. Forty-three percent of the NIE's budget would be allocated to this directorate, assuming the proportions discussed above were adopted.

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*See p. 22 for a discussion of this aspect of the matrix organizational structure.

A *Center for Education Studies* could be a fourth major NIE organizational unit responsible for the policy studies objective. In addition, the Center could have the major responsibility for generating new program ideas for the Directorate of Programs and for pursuing them through a pilot-study phase. To provide a base for policy studies and program planning activities, the Center could support a large intramural research activity--larger than in any of the other NIE models.

ORGANIZATIONAL STRUCTURE

The principal structural feature in this second model for NIE is the matrix method of organization. As mentioned above, the Directorate of Programs could draw from all three of the other directorates for staff in conducting its problem-solving activities, particularly from the Center for Education Studies. The Center could be a primary source of program design talent. The matrix method of staffing could also be used by the other directorates for special purposes: to assist the Directorate of Administration and Management in designing useful information systems, the Directorate of Educational R&D in selecting projects, and the Office of the Director in performing evaluation functions.

Internal Structure

The internal organizational structures of the Directorate of Programs, the Directorate of Administration and Management, the Directorate of Education R&D, and the Office of the Director (Tables 14 through 17) could be essentially linear. The Directorate of Programs could be organized by program and the Directorate of Education R&D by R&D objective. The three major units of the Directorate of Education R&D could be the Division of Education Science (fundamental research), the Division of Education Practice (practice-oriented R&D) and the Division of R&D Resources (institution building and training). The Directorate of Administration and Management could be organized by its major activities.

The Center for Education Studies could be a matrix organization with two dimensions, the Center's policy studies and generation of new programs on one dimension and discipline-oriented departments on the other dimension. The discipline-oriented set of departments on one dimension would be a convenient arrangement for managing the intramural research activity on which both problem-solving and policy studies would depend. This department structure would appeal to the university faculty and graduates needed to maintain the requisite quality in the Center's intramural research staff. The responsibility for performing policy-studies and generating new programs on the second dimension would be assumed by temporary task forces of staff from the departments. As a result, policy studies and generation of new programs would be the temporary dimension of the Center's matrix organization. The Center's organization is described in Table 18.

Staffing Plan

Reasonable staffing plans for the major units called for in Strategy II appear in Tables 14 through 18. As in the first NIE model, the basic management unit in the Directorate of Education R&D could be a team consisting of one Program Director and a staff of eight Associate Program Directors and four planners* who would have primary authority for all the R&D in an assigned problem area and a budget of $6 to 10 million. In the Directorate of Programs, the basic management unit would be a team consisting of management-oriented people, mostly from the Directorate of Programs, and subject matter specialists drawn from throughout the NIE.

The staffing plan for the Directorate of Education R&D has been designed to provide approximately one professional (at the level of GS-15 or lower) per approximately $800,000 of extramural projects in the Education Practice Division and one professional per $1,000,000 of extramural projects in the Education Science Division.

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*The team would have only one planner in the Education Science Division.

The staffing plan of the Directorate of Programs allows for one professional per $500,000 of extramural projects; achievable if the Center for Education Studies has 500 professionals. These ratios and levels are necessary for achieving the styles of management employed in the directorates. The ratios were achieved by assuming that roughly one-fourth of the total GS-15 man-years in the Education R&D Directorate and one-third of the total Center for Education Studies man-years are allocated to programs in the Directorate of Programs. The resulting total staff complement of 863 is almost double the staff size of Model I.

A salient feature of the staffing plans in Tables 14 to 18 is the comparatively high proportion of staff positions specified for professionals having a management background. For example, of the four Assistant Director positions, only one, the Director of the Center for Education Studies, does not have an R&D management orientation. In Model I, only one Assistant Director position specifies a strong management background. And, at the GS-17 level, the several Program Manager positions in the Directorate of Programs would be filled by skilled program managers, further providing the organization with a management approach. Throughout the organization there is a larger proportion of management analysts, program analysts, and other management-oriented professionals.

Another significant feature of the staffing plans in Model II is that the planning function has been decentralized throughout the organization by providing every Program Manager (or Director) with a small planning staff. In this way, planning would be a line responsibility and an integral part of program management. The planning staffs at higher levels have been intentionally kept small and more program-budgeting oriented than research-oriented to maintain planning as a decentralized function. To further reinforce the planning function in this model, approximately equal pay could be provided for planning staffs and their counterpart program management staffs throughout the organization.

Because of the emphasis on evaluation in the highly directed management styles that are part of Strategy II, an important staff position in this NIE model could be to establish a Director, Office

of Evaluation (see Table 14 staffing plan for the Office of the Director), who could be responsible for organizing evaluations of all NIE programs. In view of the importance given to this position, the salary could be established at the rate of GS-18, which is equivalent to the salary of the Assistant Directors of the directorates and higher than any of the Program Directors or Managers. The Director of Evaluation would have greater authority over program content in this model for the NIE than the person responsible for evaluation in either of the other models. The Office of Evaluation is discussed in greater detail on p. 81.

Another feature of the Model II staffing plan could be the use of the Center for Education studies as a principle source of developing highly qualified program managers. The emphasis on management in this model makes this a critical need. The general high quality of the Center staff and the discipline-oriented department structure would be attractive to high-quality performers from the R&D community and, therefore, would facilitate the task of recruiting them for the Center staff. Because of the matrix structure, most of those recruited would eventually be exposed to program management in contributing to a program in the Directorate of Programs. Some would become interested in taking on more program management responsibility. These staff members could be assigned to a succession of positions having gradually increasing levels of management responsibility. By this process, the NIE could develop much of its own management talent.

MANAGEMENT STYLES

Following the specification in Strategy II to use the more directed management styles, a reasonable selection for the Directorate of Education R&D, for example, would be to choose the interventionist style in the Education Science Division, the centralized style in the Education Practice Division, and the decentralized style in the R&D Resources Division. The directive style could be chosen for the Directorate of Programs. These selections are listed at the bottom of Fig. 6.

Despite making these general specifications, managerial flexibility would probably be a hallmark of the NIE if it followed Strategy II, especially in the Directorate of Programs. The Directorate of Programs would probably emphasize its ability to assemble staff members into a program management team, and structure it to meet the demands of the problem to be solved. A wide variety of plans might be used, but a typical management plan is described in Table 15. All such program management plans would probably be organic, changing to meet unexpected discoveries and growing differentially at various stages of the problem-solving sequence from design to implementation.

Program Planning

A different approach to planning could be employed in each major NIE unit, reflecting the different management styles chosen. In the Directorate of Education R&D, for example, programs in the Education Science Division could be planned in the same way as programs in the Fundamental Research Division of Model I, by determining areas of need and recruiting R&D performers to work in these areas. Programs in the Education Practices Division could be more carefully planned. Each program in the division could have a planning staff of four (or five) that would continually examine research related to the program, work with practitioners to detect and diagnose problems, and prepare program plans. A statement of the program's R&D objectives could be disseminated annually to the R&D performing community to inform them of the problems that the NIE considered important. In the R&D Resources Division, needs for the centers and R&D manpower training could be determined by the Program Directors in the other divisions with coordination provided by the R&D Resources Division staff. The plans for training projects could be implemented by the Program Directors in the other divisions by stimulating proposals in high-priority areas. Often these proposals could be promoted in conjunction with an R&D project to enhance the quality of the training experience. The plans for centers could be implemented by the R&D Resources Division staff by stimulating applications for new centers and by reallocating the budget among the existing centers.

Planning in the Directorate of Programs could be more detailed and specific than in the Directorate of Education R&D, even more detailed than in the problem-solving activity in Model I. As previously specified, most ideas for problem-solving programs could originate in the Center for Education Studies as a by-product of conducting intramural research and policy studies. The Center would develop these ideas through an experimental pilot-study phase to test feasibility and promise. The Director of NIE could then choose which programs to transfer to the Directorate of Programs. Some of the Center staff involved in the pilot studies could continue working on the programs, constituting a nucleus of staff. More staff would be added, including a program manager, and then the program would be further developed. This development could include selecting a specific end objective and a detailed plan of intermediate objectives and resource requirements. In most cases, such a plan would be frequently modified throughout its duration.

Project Generation

As a consequence of choosing the most directed management styles, a large proportion of project ideas would be generated by internal staff. In the Education Practice Division, the Program Planning Staffs and the Associate Program Directors could identify projects that have particular relevance to a practical need and could arrange contracts for getting the work done. Most of the division's projects, however, would be unsolicited. In the Directorate of Programs, almost every project idea could be generated by internal staff, written into a Request for Proposal, and circulated for competitive bid. Because of this strong reliance on internal generation of project ideas, the NIE's internal research staff, particularly the planning staffs and the staff of the Center for Education Studies, would have to be of exceptionally high quality. The importance of having high-quality staff in this NIE model, where so many of the project ideas are generated internally, is difficult to overemphasize.

Evaluation

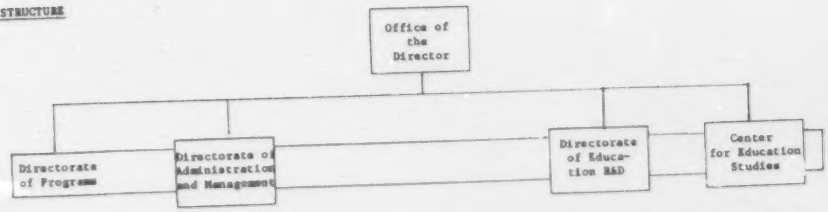
The management-orientation of this strategy is evident in the evaluation phases of R&D management which, because of the use of highly directed management styles, would receive more attention than in any of the other NIE models. Evaluations could be conducted at three different levels.

Project Evaluation. One type of evaluation could be carried out at the project level, which would consist of retrospective evaluation of single projects or perhaps groups of projects addressing the same issue. This evaluation function could be the responsibility of the Office of Project Evaluation in the Office of the Director. The Office of Project Evaluation could (1) evaluate the research methodology of NIE projects on a sample basis (as a check on research quality) and (2) evaluate the technical validity of R&D projects at the request of users (particularly for their use in determining policy). The Office of Project Evaluation could also maintain records of contractor and grantee performance to aid in selecting future project performers.

Program Evaluation. Two other types of evaluation could be conducted at the program level. One could be internal program reviews: each Program Director would address a panel of Directorate Managers annually on the objectives, progress, and needs of his program. The panel could consist of the Assistant Director plus the first level of managers, all from the directorate of the program being reviewed. The panel could question the Program Director in a number of areas including particularly the relationships between his program and the others. A second, more comprehensive type of evaluation could be the assessment of larger segments of NIE activity at regular, multiyear intervals. These assessments could be organized by the Office of Evaluation but conducted by outside organizations. The Director of the Office of Evaluation would have to be an exceptionally strong and management-oriented individual, and be firmly backed by the NIE Director to maintain the integrity of this evaluation function.

Fig. 6--Model II: Produce R&D Results

ORGANIZATION: MATRIX STRUCTURE


Office of the Director
Directorate of Programs
Directorate of Administration and Management
Directorate of Education R&D
Center for Education Studies

ACTIVITIES	Manage programs to solve important national problems.	Organize internal program reviews. Build information systems for use by other directorates in problem analysis. Analyze manpower utilization throughout the institute. Perform other administrative functions.	Influence formation of national education policy. Allocate R&D resources to the divisions.	Sponsor extramural research in the education sciences. Sponsor extramural practice-oriented R&D. Support the training of R&D manpower. Provide subject matter expertise and manpower to the other divisions.	Conduct policy studies. Conduct intramural research. Provide subject matter expertise and manpower to other NIE divisions. Prepare initial plans for directed, problem-solving efforts.	
		Percent of the NIE Budget Expended on Extramural Activities				Total
OBJECTIVES						
Problem-solving	50%	--	--	--	--	50%
Practice-oriented R&D	--	--	--	25%	2%*	27% (30%)**
Fundamental research	--	--	--	10%	--	10% (12%)**
Linkage to practice	--	5%***	--	--	--	5%
Manpower improvement	--	--	--	3%	--	3%
Institutional development	--	--	--	5%	--	5%
Total	50%	5%	0%	43%	2%	100%
DIVISION STAFF, PROFESSIONAL†						
Intramural research	--	--	10	--	525††	535
Extramural management	90	25	40	173	--	328
Total	90	25	50	173	525	863
MANAGEMENT STYLE	Problem-solving: directive	--	--	Fundamentalist R&D: interventionist Practice R&D: centralized Institutions: decentralized	--	

*For the purpose of funding pilot studies to test ideas for major NIE programs.

**Figures in parentheses include institutional development.

***The Directorate would support a data-collection network that all directorates would use as an aid in problem analyses.

†Based on a total extramural budget of $300 million.

††Most work temporarily on a part- or full-time basis for the Directorate of Programs.

Table 14

DETAILED PLAN FOR THE OFFICE OF THE DIRECTOR

ORGANIZATIONAL STRUCTURE

The Office of the Director would consist of three principal offices: the Office of Evaluation, the Office of Planning and Budgeting, and the Office of Project Evaluation.

ACTIVITIES

Office of Evaluation

Organizes and manages comprehensive reviews of major segments of the NIE's activities at multiyear intervals to assess progress and recommend changes of direction and management.

Office of Planning and Budgeting

Prepares long-range budget plans for the NIE and assists the Director in selecting programs for the Directorate of Programs.

Office of Project Evaluation[a]

Maintains records of contractors' performance for use in contractor selection.

Evaluates the technical validity of individual projects supported throughout the NIE on a sample basis.

Evaluates the methodological accuracy of any R&D project at the request of users.

STAFFING PLAN

Director, NIE
Salary: Executive Level IV.

Deputy Director, NIE
Salary: GS-18 equivalent.

Director, Office of Evaluation
Salary: GS-16 equivalent.
Background in government R&D budgeting; for example, experience in the Office of Science and Technology or the Office of Management and Budget.

Office of Evaluation Staff
Salary: GS-15 to GS-17.
Total of four members on the staff.
Experience in organizing program evaluations, for example, as an Executive Secretary in the National Academy of Sciences.

Director, Office of Planning and Budgeting
Salary: GS-17 equivalent.
Manages a staff of eight program budget analysts and examiners.

Director, Office of Project Evaluation
Salary: GS-16 equivalent.
Manages a staff of eight members. The staffs' backgrounds would be in research and/or program management.
Some staff would have a joint appointment with the Center for Education Studies.

MANAGEMENT PLAN

Program Evaluation
A variety of methods would be used to evaluate NIE activities at multiyear intervals: ad hoc peer committees managed by NIE, contracts with research institutes and firms, or reviews conducted by the National Academy of Education.

Project Evaluation
A variety of methods would be used to evaluate NIE projects, including ad hoc committees of peers managed by NIE, contracts with research institutes and firms, and analyses conducted by NIE staff.

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[a] R. Krughoff, "Organizational and Process Models for NIE," Department of Health, Education, and Welfare internal memorandum, April 14, 1972.

Table 15

DETAILED PLAN FOR THE DIRECTORATE OF PROGRAMS

ORGANIZATIONAL STRUCTURE

The Directorate of Programs would consist of several Program Offices, one for each program assigned to the directorate.

ACTIVITIES

Most programs would be broad-scale attacks on chronic educational problems, although other programs would also be conducted under Objective I. Each program would consist of a number of projects spaced over a finite number of years.

Some programs might contain experimental intervention activity; some might be large-scale policy studies involving substantial data collection. Others might support a nationwide effort to improve basic skills (for example, reading), or an effort to establish a new segment in the education system (for example, parent education).

PERFORMING COMMUNITY

Single or multiyear project contracts would be awarded mostly to teams of performers rather than to individuals.

These performers would be located almost exclusively in nonprofit R&D institutes, private R&D organizations, education agencies, or wherever needed talent could be found.

Assistant Director for Programs
Salary: GS-18 equivalent.
Extensive background in managing technological development programs.*

Program Manager**
Salary: GS-17 equivalent.
One manager per program.
Experience in managing R&D and large programs.
Allocates budget to projects.

Contract Management Staff**
Salary: GS-12 to GS-16.
Provide contract management services.
Provide project management analysis.
Manage contractor selection panels.

Program Advisory Panel
Salary: per diem pay, one or two weeks per year.
Total of five to ten members broadly representative of the program's concerns.

Administrative Support Staff**
Salary: GS-12 to GS-16.
Personnel services.
Financial and accounting services.
Conference arrangements.

Planning, Budgeting and Analysis Staff**
Salary: GS-12 to GS-16.
Organize the generation and continual updating of a detailed program plan.
Prepare budget projection and program-budgeting analyses.

Project Management Staff**
Salary: GS-12 to GS-16.
Manage all other projects conducted by the program.

Design Group**
Salary: GS-12 to GS-16.
Entire staff "matrixed" from other NIE major units.
Generate project ideas and plans; design experiments.

Information and Data Systems Staff**
Salary: GS-12 to GS-16.
Entire staff matrixed from other NIE major units.
Establish and manage data-gathering.

Experiment Management Staff**
Salary: GS-12 to GS-16.
Organize and manage experiments conducted by the program.

Marketing and Distribution Staff**
Salary: GS-12 to GS-16.
Manage the implementation of program results.

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*Each program would be structured to fit the problem being solved. The structure outlined in this table is an example of one possibility.

**The staff manager (GS-16 salary) would be a permanent employee of the Directorate of Programs in most cases. Most of the remaining staff (GS-12 to GS-16) would be "matrixed" from another NIE major unit.

Table 15 (Continued)

MANAGEMENT PLAN

Program Planning

A detailed plan, possibly of the convergence-type,* would be prepared. A specific target objective and intermediate decision criteria would be specified. The plan would be continually updated throughout the life of the program.

All program staffs, but particularly the Design Group, would be involved in generating and modifying the program plan.

Program plans would be presented to the Assistant Director for Programs and the Program Advisory Panel.

Program Development

Project Generation. Most projects would be generated and planned in detail by the program staff (particularly the Design Group). A Project Management Staff member and the project originators would write out a project RFP.**

Unsolicited proposals would also be considered by either the Design Group, the Program Manager, or both.

Project Selection. A Contract Management Staff member would convene a panel of NIE staff to review each project RFP for appropriateness to program plans and contractor selection criteria.

The same panel would review all proposals submitted in response to the RFP and recommend those few judged to be the most competitive.

The Program Manager would select the best proposal in consultation with program staff.

Unsolicited proposals would also be reviewed by a panel of NIE staff and require the Program Manager's approval for funding.

Project Monitoring. A member of the Project Management Staff or Experiment Management Staff would be assigned (full-time on projects over $500,000) to monitor each project funded.

A regular management-by-objectives review would be conducted quarterly before a panel consisting of the Program Manager and the staff group leaders.

Project Evaluation. The Design Group would examine completed projects to interpret the implications of the results for program activities.

Program Evaluation

Annual progress reviews would be presented to the Assistant Director for Programs and the Program Advisory Panel.

The Office of Evaluation in the Office of the Director would conduct an independent review midway during the program's lifetime.

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*Carnese, L., "The Convergence Technique: A Method for the Planning and Programming of Research Efforts," *Management Science*, Vol. 13, No. 8, April 1967, p. 248.

**Request for Proposal.

Table 16

DETAILED PLAN FOR THE DIRECTORATE OF ADMINISTRATION AND MANAGEMENT

ORGANIZATIONAL STRUCTURE

The Directorate of Administration and Management would have three principal offices concerned with program substance: the Office of Program Review, the Office of Information and Data Systems, and the Office of Manpower Analysis.*

ACTIVITIES

The Office of Program Review would organize and manage periodic reviews of all NIE extramural programs for the purpose of keeping each Assistant Director informed of the objectives, progress, and needs of each program in his directorate.

The Office of Information and Data Systems would, in cooperation with the Deputy Director for Policy Studies in the Center for Education Studies, design and operate an information system to collect information useful to NIE planners and policy analysts.

The Office of Manpower Analysis would monitor the assignment of personnel within the NIE to check on the functioning of its matrix organization.

The Office would also provide consultation on organizational development to the other NIE major units.

STAFFING PLAN

Assistant Director, Administration and Management
Salary: GS-18 equivalent.
Background in government administration.

Director of Program Review
Salary: GS-16 equivalent.
Manage a staff of three assistants.

Director, Information and Data Systems
Salary: GS-17 equivalent.
Background in policy analysis and data systems.
Manage a staff of ten researchers and project managers; Five or ten other researchers would have a joint appointment with the Center for Education Studies in a "matrixed" arrangement.

Director, Manpower Analysis
Salary: GS-16 equivalent.
Background in personnel management and organizational development.
Manage a staff of three analysts, and management specialists.

MANAGEMENT PLAN

Program Review

Program reviews would be conducted annually for the Directorate of Education R&D and quarterly for the Directorate of Programs. Each Program Manager or Director would prepare a one-hour briefing and supporting documentation for presentation to his Assistant Director.

Program reviews would cover the objectives of a program, the progress with respect to objectives, and program needs. Program reviews would be attended by other Program Directors and Managers for communication purposes.

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*Another office would be included also, to provide administrative services.

Table 17

DETAILED PLAN FOR THE DIRECTORATE OF EDUCATION R&D

ORGANIZATIONAL STRUCTURE

The Directorate of Education R&D would consist of three divisions: the Division of Education Science, the Division of Education Practice, and the Division of R&D Resources. Each division would consist of a number of programs. Each program would support a number of extramural R&D projects.

	Education Science Division	Education Practice Division	R&D Resources Division
ACTIVITIES	Fundamental research activities (Objective III) would be supported, with an emphasis on philosophical and historical inquiry into the goals of education.	Practice-oriented R&D activities (Objective II) would be supported, particularly to develop R&D methodology, develop curriculum, investigate decision policies, evaluate educational programs, and build quantitative models.	R&D institutional development (Objective VII) and R&D manpower improvement (Objective VI) would be the principal activities.
PERFORMING CAPABILITY	Multiyear contracts would be awarded to individual investigators or a multidisciplinary team of investigators. Most of these investigators would be university faculty.	Multiyear contracts would be awarded generally to teams rather than individual performers. Less than one-fourth of these performers would be university faculty. The remainder would be with nonprofit research institutions, private R&D firms, education agencies, or wherever the needed talent could be found.	Full support would be given to selected R&D centers during their early years, but subsequently only core support (Objective VII) would be provided to some institutions. Training would be performed on a multiyear project grant basis. Most training projects would be operated in conjunction with an active R&D project to enhance their effectiveness.

STAFFING PLAN

Assistant Director, Education R&D
- Salary: GS-18 equivalent.
- Background and reputation in R&D management and research.
- Allocates directorate's budget to the divisions.

Division Director, Education Science
- Salary: GS-17 equivalent.
- Background and reputation in research.
- Allocates division budget ($30 million) to five programs.

Deputy Division Director, Planning
- Salary: GS-16 equivalent.
- Background in R&D planning.

Program Director
- Salary: GS-16 equivalent.
- Total of five in the division.
- Background in research and program management.
- Manages a team of six Associate Program Directors and one Program Planner.

Program Planning Staff
- Salary: GS-12 to GS-15.
- Total of five in the division, one per program.
- Background in research.
- Reports to a Program Director and Deputy Division Director for Planning.

Associate Program Directors
- Salary: GS-14 to GS-15.
- Total of 30 in the division.
- Manages research in an assigned subject area.

Division Director, Education Practice
- Salary: GS-17 equivalent.
- Background and reputation in R&D management.
- Allocates division budget ($69 million) to seven programs.

Deputy Division Director, Planning and Management Office
- Salary: GS-16 equivalent.
- Background in program and policy analysis.

Planning and Management Staff
- Salary: GS-12 to GS-15.
- Total of ten in the division.
- Some staff with background in program analysis; some with background in management systems.
- Responsible for preparing a statement of R&D priorities and designing and operating needed management control systems.

Program Director
- Salary: GS-16 equivalent.
- Total of seven in the division.
- Background in R&D program management.
- Manages a team of eight Associate Program Directors and a planning staff.

Program Planning Staff
- Salary: GS-12 to GS-15.
- Total of four per program.
- Background in research, education, or program analysis.

Associate Program Director
- Salary: GS-14 to GS-15.
- Total of 56 in the division.
- Background in research, education, or management.
- Manages R&D activity in an assigned subject area.

Division Director, R&D Resources
- Salary: GS-17 equivalent.
- Determines budgets for the centers.

Deputy Division Director, Planning
- Salary: GS-16 equivalent.
- Background in R&D management.
- Organizes development of new centers.

Center Program Managers
- Salary: GS-15.
- Total of three in the division.
- Manage the centers program.

Training Program Managers
- Salary: GS-15.
- Total of three in the division.
- Manage training projects.

Table 17 (Continued)

MANAGEMENT PLAN	Program Planning A statement of broad research priorities, especially new initiatives needed, would be prepared annually by the Planning Deputy. Associate Program Directors would implement the plan by recruiting researchers in priority areas and by adjusting their project selection decisions. Program Development Project Generation. Project ideas would be generated by individual researchers and submitted for funding. Project Selection. All proposals with a chance for funding would be sent to mail reviewers for technical evaluation. Associate Program Directors would determine the list of projects to be supported in their area in consultation with other Associate Program Directors and the Program Director. Project Monitoring. Projects would not be monitored substantively. Program Evaluation Program activities reviewed periodically (for example, every five years) by the Office of Evaluation in the Office of the Director.	Program Planning Each program would prepare a statement of its objectives annually, some in specific terms and some in general terms. The Planning and Management staff would coordinate these planning efforts. Key projects would be specified by the Program Planning Staffs through evaluations of R&D activities and model-building exercises. Program plans would be implemented by disseminating R&D objectives and competitively contracting for key projects. Program Development Project Generation. Individual investigators would generate project ideas responding to the R&D objectives and submit them for funding. Performers for key projects would be solicited by Associate Program Directors. Project Selection. The Deputy Division Director would convene a panel of NIE personnel to review the plans for key projects, review the Request for Proposal for the key projects, and select the best bidder. All other projects would be selected as in the Education Science Division, except that selection of mail reviewers would be monitored by the Planning and Management Office. Project Monitoring. Key projects, especially large evaluations, would be closely monitored by the project panel and an Associate Program Director assigned almost full-time. Program Evaluation The Office of Program Review would manage an annual "management-by-objectives" review (before the Assistant Director and the Division Directors) of all programs. The Office of Evaluation in the Office of the Director would also sponsor periodic reviews as in the Educational Science Division.	Program Planning The Division's Planning Deputy would work with the Planning Deputies of the other divisions and with the Center for Education Studies to determine what new centers are needed. Needs for training projects would be determined by the other divisions. Program Development Project Generation. Center Program Managers would put much of their effort into organizing the nucleus of new R&D centers. Training projects would be stimulated by Program Directors in the other divisions to meet their priority needs. Others would be submitted unsolicited. Project Selection. Center budgets would be established triannually by the Division Director. All training proposals with a chance for funding would be sent to mail reviewers. The Training Program Directors would determine the list of projects to be supported, but would respond to the needs stated by the other divisions. Program Evaluation Each center would be rigorously evaluated triannually. The division would utilize site-visiting panels of researchers and management experts. Training activities would be evaluated by the Office of Evaluation in the Office of the Director.

Table 18

DETAILED PLAN FOR THE CENTER FOR EDUCATION STUDIES

ORGANIZATIONAL STRUCTURE

The Center would consist of five discipline-oriented departments, for example, human development, social science, education, economics, and management sciences.

ACTIVITIES

Center for Education Studies

Assistance to the NIE Director in advising NSB on the implications of R&D for educational policy.

Studies of the state of American education.

Generation of ideas for new NIE programs, particularly programs for the Directorate of Programs.

Technical consultation to other NIE major units.

Managerial and technical manpower provided to the Directorate of Programs.

STAFFING PLAN

Assistant Director for Educational Studies
Salary: GS-18 equivalent.
Background and reputation in research and managing a research center.

Deputy Director for Policy Studies
Salary: GS-17 equivalent.
Coordinate teams of Center analysts who conduct policy studies and present the results to the NIE Director.

Deputy Director for New Programs
Salary: GS-17 equivalent.
Stimulate the generation of program ideas and organize small teams to develop these ideas.

Department Chairman
Salary: GS-17.
Total of five in the Center.
Reputation in research.
Staffs the Center and conducts a program of intramural research.

Center Staff
Salary: GS-11 through GS-15.
Total of 50 in the Center.
Backgrounds mostly in research and policy studies, but also educational practice and other fields.
At least 40 of the staff would have fellowship appointments. These appointees would be widely recognized scientists, administrators, practitioners, and public figures.

MANAGEMENT PLAN

Program Planning
Needs for policy studies would be determined jointly by the NIE Director and the Center Director. The Center staff would also generate policy issues to be analyzed.

Program Planning
Analysis of American education and other Center activities would suggest ideas for large-scale directed programs. Generation of these ideas would be encouraged and supported through initial stages of planning by the Deputy for New Programs.

The NIE Director would decide which programs to transfer to the Directorate of Programs for full-scale development.

The Center would support a limited number of pilot studies to test program ideas.

Program Evaluation
The Office of Evaluation in the Office of the Director would conduct comprehensive evaluations of Center activities at regular intervals (perhaps every five years).

V. NIE MODEL III: SUPPORT DISCIPLINED CHANGE

OVERVIEW

The third model for NIE implements Strategy III, the strategy based on the Support-Disciplined-Change plan for organizing the R&D performer community. Many of the organizational and managerial techniques employed in the model are used by the Office of Child Development or the Office of Economic Opportunity, but others have been specifically designed to satisfy particular parts of Strategy III.

As specified in Sec. II, choosing the Support-Disciplined-Change plan for organizing the R&D community implies the following choices of the other design elements:

1. Objectives: practice-oriented R&D (Objective II) is emphasized.
2. Division of responsibility: By R&D objectives.
3. Organizational structure: Linked or matrix.
4. Management style: At most, moderately directed.

The principal question in this strategy is whether to use a linked or matrix structure. There are no strong reasons for preferring either of these structures; however, a choice must be made. Because problem-solving is a moderately important activity in this strategy and because, as described in the previous section, the matrix organizational structure is advantageous in conducting problem-solving activity, the matrix structure is chosen for this model of the NIE.

The reliance on inventive practitioners for program and project ideas and the greater use of experimental interventions would (in most conceivable models following Strategy III) tend to make the NIE *externally* oriented. The use of moderately directed management styles (if used) would tend to make the NIE *internally* oriented. Taking these factors in balance, the NIE would probably be somewhere midway in its orientation between the extreme external orientation of Model I and the extreme internal orientation of Model II.

OBJECTIVES

A reasonable distribution of the NIE's budget among the R&D objectives consistent with the Strategy III would be approximately 20 percent for problem-solving (Objective I), 55 percent for practice-oriented R&D (Objective II), 15 percent for fundamental research (Objective III), and 5 percent for training R&D personnel (Objective VI). These proportions, modified slightly to allow for some other specific NIE activities, are listed in Fig. 7. Of the amount specified for practice-oriented R&D, 10 percent (or 5 percent of the total NIE budget) would reasonably be allocated to support practice-oriented R&D institutions. Of the amount specified for fundamental research, 33 percent (or 5 percent of the total NIE budget) would reasonably be allocated to direct support of fundamental research institutions. All these institutions would be located at various sites across the country.

Strategy III implies that the form of this institutional support should be the same as in Model I--an institutional grant--but for a different reason. Strategy III specifies that a portion of the R&D supported by the NIE should serve as a check on the experimental intervention activities that are emphasized. By providing a number of R&D institutions with a sizeable grant of almost guaranteed, long-term support, these institutions would more likely conduct R&D that challenges the experimental intervention activities supported by the NIE. However, because of the limited proportion of the NIE's funds allocated to institutions and the policy of providing institutional grants, substantially fewer R&D institutions could be supported with this strategy than with either of the other strategies.

The smaller number of R&D institutions supported means that a network of R&D institutions, each serving most of the needs of a region, would be infeasible. Instead, with Strategy III, the NIE would probably have the R&D institutions it supports specialize in a limited subject or problem area. As another means of providing an independent check on the NIE's other R&D activities, one or two of these institutions might be specified as policy study centers. Approximately 5 percent of the NIE's resources could reasonably be allocated to these extramural policy study centers.

Activities

Strategy III implies that demonstration and large-scale experiments (which are included in Objective II) would be a more prominent activity in Model III than in either of the models based on the first two strategies.* The deemphasis on long-range planning in Strategy III** and the limited resources allocated to problem-solving suggests that broad-scale attacks on chronic educational problems probably would not often be attempted. Strategy III does not imply that other activities supporting objectives should be particularly emphasized or deemphasized.

Performing Community

With this model for the NIE, a larger proportion of the educational R&D performers would probably be practitioners than with the models designed to implement either of the other strategies. In addition, many of these practitioners would probably be educational innovators not closely associated with an established educational system. This large proportion of practitioners is a likely result of the emphasis on invention and experimentation as practice-oriented R&D activities. Thus, in general, there would probably be a much greater involvement of so-called social activists in the NIE's programs and more of an action orientation.

DIVISION OF RESPONSIBILITY

A matrix organizational structure and division of responsibility by R&D objectives has been chosen for Model III, but a specific

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*The term "demonstration" is used to describe an educational intervention undertaken early in the development of a concept to test its basic soundness and to explore alternative approaches to its realization. In demonstrations, evaluation is, for the most part, done qualitatively and subjectively. The term "experiment" is used to describe an educational intervention undertaken to rigorously validate the effect of a large-scale educational development and measure how it can be improved. In experiments, evaluation is much more quantitative and thorough, including a much clearer exposition of goals than in demonstrations: clearly, there is a continuum of types of interventions between the two extremes.

**See the discussion on p. 40.

assignment of R&D objectives to the major units in the matrix organizational structure has not been made. This will be resolved by making a number of choices that are guided by our understanding of Strategy III.

We can divide responsibilities among three major units of organization, compared to four in the previous models. The assignment of responsibility to major units chosen is shown in Fig. 7. Tables 19 through 21 provide detailed plans of these major units.

As was discussed previously,* the experimental intervention activity emphasized within the practice-oriented R&D objective in Strategy III could be assigned to one major unit called the *Office of Experimentation and Innovation.*** Of the portion of the NIE budget allocated to practice-oriented R&D, 70 percent (or 35 percent of the total NIE budget) could reasonably be assigned to this office. It could be responsible for stimulating and generating ideas for experimental interventions, organizing pilot projects, and developing basic concepts into working models. As discussed in Strategy III, this development sequence would require many years to reach a mature stage of development.

At the mature stage of development of a model, when a significant proportion of the Office of Experimentation and Innovation's budget would typically be spent on the model, it could be transferred to a second major unit called the *Office of Programs*. The NIE would probably consider these so-called mature interventions as part of Objective I--exploiting significant research accomplishments.

The Office of Programs could also have responsibility for conducting other problem-solving activities included in Objective I. By assigning all the problem-solving responsibility to the Office of Programs, an organizationally distinct unit for handling urgent requests for R&D products would be provided, thereby allowing the Office of Experimentation and Innovation and other major units of the NIE to concentrate on long-range goals.***

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*Sec. II, p. 49.

**The Experimental Schools program currently supported by the Office of Education could be part of this office.

***The importance of this feature was discussed on p. 49.

The Office of Experimentation and Innovation could also support a small amount of fundamental research (Objective III) in addition to practice-oriented R&D as a means of tapping the research community for new program ideas and stimulating fundamental researchers to work on relevant problems. The amount of support could be small, for example, 1 percent.

The third major NIE unit, the *Office of Education R&D*, could have very similar responsibility to the Directorate of Education R&D in Model II for the NIE: fundamental research (Objective III),* manpower improvement (Objective VI), institutional development (Objective VII), and practice-oriented R&D (Objective II), excluding experimental intervention activity. In fulfilling this responsibility, the Office of Education R&D could counterbalance the Office of Experimentation and Innovation in a number of ways: by setting higher standards of technical rigor instead of compromising precision for practicability,** by investigating the same problems being addressed by the Office of Experimentation and Innovation with different (more conventional) R&D methods, and by investigating problems not being addressed by that office. The Office of Education R&D would thus be in tension with the Office of Experimentation and Innovation and serve as an evaluative check on its intervention activities.

In terms of the budget for each of these offices, the choices that have been made above result in a budget with 44 percent for the Office of Education R&D and 36 percent for the Office of Experimentation and Innovation, a condition of approximate equivalence.*** As will be described in a subsequent section, however, the staff of the Office of Experimentation and Innovation would need to be much

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* Except for the fundamental research supported by the Office of Experimentation and Innovation.

** See p. 42.

*** The Office of Education R&D's budget can be obtained by subtracting the practice-oriented R&D and the fundamental research activities supported by the Office of Experimentation and Innovation from the aggregate distribution selected above for Model III. The results of this calculation are shown in Fig. 7.

larger--about three times as large. The extra staff would be mostly intramural researchers and other support personnel, but when added to the managers of extramural activities, this staff would probably constitute a very strong force difficult for the rest of the institute, and particularly the *Office of the Director*, to control. In studying R&D management in federal agencies, we have observed that programs containing a large, intramural component that is permanent and integrated with the programs tend to have great inertia. The Office of Experimentation and Innovation's method of taking a long-run view of educational improvement would probably also tend to reduce the Director's control over the office. Moreover, the office's programs would be highly visible, since they would be educational interventions, and might, on occasion, be able to generate substantial public support. Since a significant proportion of the NIE's extramural budget (36 percent) would be spent by this office, and its autonomy is potentially so great, there is danger that there would be a significant imbalance of power within the NIE.

To counteract this possibility, the Office of the Director could be given greater power in this model. This power could be established in the following ways:

- Assign responsibility for conducting policy studies to the NIE Director.
- Assign intramural researchers to the Office of the Director to assist with policy studies.
- Establish a strong capability in the Office of the Director for evaluating all NIE programs.
- Establish a vigorous external relations capability to introduce pressure for change in NIE programs.
- Assign responsibility for generating new NIE programs to the Office of the Director.

To assume these responsibilities, the Office of the Director would probably need a larger staff than in either of the other NIE models. The suggested staff for the Office of the Director in Model III

is shown in Fig. 7: 81 permanent professional positions, or 60 percent larger than the staff of Model II and 800 percent larger than that of Model I. The internal procedures of this Office of the Director will be discussed in part of the next section.

ORGANIZATIONAL STRUCTURE

The matrix method of organization has been chosen for achieving coordination in this third model for the NIE. One application of the matrix method would be that mature interventions transferred from the Office of Experimentation and Innovation to the Office of Programs could have personnel transferred along with them on a temporary basis. Another application could be that other programs in the Office of Programs would draw on any of the other NIE offices for design and management assistance. Programs in the Office of Programs would be of finite duration and, therefore, the Office of Programs would be the temporary dimension of matrix organization.

The matrix method of staffing has also been chosen for part of the Office of the Director, but detailed discussion of this arrangement is deferred until the section entitled "Staffing Plan."

Internal Structure

The internal structures of the Office of Programs and the Office of Education R&D could be essentially linear as in Model II, with similar division into organizational units. The Office of Programs could be organized by program (problem) and staffed in virtually the same way as the Directorate of Programs in Model II. The internal structure could be so similar to the Directorate of Programs in Model II that an organizational and managerial plan for the Office of Programs will not be included in this Model III. (Readers can refer to Table 15 for a detailed plan of that directorate.) As in Model II, the Office of Education R&D could be divided by R&D objectives into the *Division of Education Foundations*, the *Division of Education Practice*, and the *Division of Institutional Resources*. The staffing and management plans are shown in Table 21.

The internal structure of the Office of Experimentation and Innovation could be essentially linear also, with a division of responsibility by subject area or problems, whichever was compatible with the interests of the office. The divisions within the office could appropriately be called centers. Each center could have an area of interests in which its energies would be concentrated, and in the aggregate, the centers could cover only a portion of the range of possible educational concerns. For example, early childhood (up to eight years of age), language and reading, teacher education, or educational incentives could be the domain of a center. Centers would not be viewed as permanent organizational units, although the long-range perspective that Strategy III prescribes for this office would tend to make permanent units of the centers for all practical purposes.

Within each center, responsibility could probably be organized satisfactorily in a number of ways. One attractive way could be to adopt a variation of the method followed by the Office of Planning, Research, and Evaluation in the Office of Economic Opportunity (OEO). Following the OEO plan, the center could consist of three separate functionally divided groups:

- An *Experiment Organization and Design Group* that would organize performer teams for experiments and demonstrations, organize constituency support for these experiments and demonstrations, prepare the technical designs, and generate ideas for new intervention programs.
- A *Policy Research Group* that would conduct intramural research pertinent to the center's responsibility, generate ideas for new intervention programs, and prepare analyses of program issues for the center director.
- An *Evaluation Group* that would analyze natural experiments for program ideas, prepare evaluation designs for experiments and demonstrations, conduct formative evaluations of ongoing programs, and analyze completed experiments and demonstrations to recommend what should be done next.

With this division of responsibility, each center would typically be involved with developing a number of distinct (but possibly related) concepts, and all three groups could be concerned simultaneously with all these concepts. Each group would approach a concept from a different perspective (assuming staff are properly chosen) and the center director could encourage strong interactions among the groups as a means of generating constructive criticism and creative insights. The Experiment Organization and Design Group could be the most action-oriented; the Policy Research Group, the most academic and fundamental; and the Evaluation Group, the most disciplined in terms of the precision of measurement demanded.

The Office of the Director could also be structured linearly and divided according to its functional responsibilities. Five principal units within the Office of the Director could be the *Office of Planning and Budgeting*, the *Office of Evaluation*, the *Office of Policy Studies*, the *Office of External Relations*, and the *Office of Administrative Services*. The Office of Planning and Budgeting could prepare annual and long-range budget plans for the NIE supported by program analyses. The Office of Evaluation could have responsibilities equivalent to the Office of Evaluation in Model II (Table 14)--organization of major reviews of all NIE programs, including the centers in the Office of Experimentation and Innovation at approximately five-year intervals. The Office of Policy Studies could have a dual responsibility similar to the Center for Education Studies in Model II (Table 18)--conducting policy studies and generating ideas for new NIE programs. The Office of External Relations could organize constituency support for the NIE's programs and for changes in them. The Office of Administrative Services will not be discussed in detail since it will not be assigned any direct role in managing the substance of the NIE's R&D programs. A detailed plan for the Office of the Director appears in Table 19.

Staffing Plan

Reasonable staffing plans for the NIE to follow in implementing Strategy III appear in Tables 19 through 21 for all offices except the

Office of Programs and in Table 15 for the Office of Programs. Similar to the other models for the NIE, the basic management unit in the Office of Education R&D could be a team consisting of one Program Director and a staff of several Associate Program Directors and two planners,* who would have primary authority for all the R&D in an assigned problem area and a budget of $5-7 million. In the Office of Programs, the basic management unit would also be a team consisting of management-oriented people, mostly from the Office of Programs, and subject matter specialists drawn from throughout the NIE just as in Model II.

The staffing plan in the Office of Experimentation and Innovation would be different due to its organizational structure. The Evaluation Group could be staffed with professionals from a mixture of backgrounds: survey research, evaluation design, and subject matter relevant to the center's interests. The evaluation staff could be evenly divided by research discipline between personnel from the quantitative, analytical fields and the "softer," social and behavioral fields. The Policy Research Group could consist of highly qualified educational researchers and policy analysts. The Experiment Organization and Design Group could be the most distinctive, the majority of its staff having a background in political organization, community relations, or educational practice. The Experiment Organization and Design Group could also include a number of specialists in experimental design who would be more research-oriented than the others in the group.

The staffing plans for the offices have been designed to provide approximately one professional per $800,000 of extramural projects in the Division of Education Practice; one per $1,000,000 in the Division of Education Foundations; one per $500,000 in the Office of Programs and one per $350,000 in the Office of Experimentation and Innovation. These ratios were achieved by assuming that approximately one-fifth of the professional man-years in the Office of Education R&D and the

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*A team would not have any planners in the Division for Education Foundations.

Office of Experimentation and Innovation are allocated to programs in the Office of Programs. The comparatively low ratio of project dollars to staff in the Office of Experimentation and Innovation is assigned to provide the extra staff capacity needed for project organizing while still providing enough technical design capability to maintain strong control over program content. The resulting staff complement of 606 is midway between the staff sizes for Models I and II.

The manpower for the Office of the Director could be partly permanent staff and partly "matrixed" staff from the Office of Experimentation and Innovation. Staff from the Experiment Organization and Design Groups in the Office of Experimentation and Innovation could work for the Office of External Relations. Staff from the Policy Research Groups could work for the Office of Policy Studies. And, staff from the Evaluation Groups could be matrixed to the Office of Planning and Budgeting to do program analyses. Staff from the Evaluation Groups would probably not be matrixed to the Office of Evaluation in order to maintain its independence. These matrix relationships would probably have the extra advantage of facilitating the termination of a center in the Office of Experimentation and Innovation and starting a new one, should this be desirable, since the center staffs could easily be transferred to the Office of the Director or to other center staff groups. This matrix relationship between the Office of the Director and the Office of Experimentation and Innovation is not indicated in Fig. 7. The arrangement is, however, indicated in the individual staffing plans.

MANAGEMENT STYLES

The last selection to be made in Model III is management styles and procedures for each of the offices. Strategy III implies that for most of the NIE's program activities, management styles that are moderately directed to least directed should be chosen.

A reasonable selection for the Office of Education R&D is the interventionist style, but with one major modification: instead of

internal staff selecting R&D projects as specified for the interventionist style, internal staff could select projects in a joint meeting with a review panel composed of R&D performers and others from outside the NIE. The reason for introducing a peer review panel in the project selection process is to strengthen the capability of the Office of Education R&D to resist pressures from the other NIE offices to support particular R&D activities. The Office of Education R&D's independence could also be increased by using a larger number of panels per dollar of projects evaluated than in the previous NIE models where review panels were specified. The independence provided by these two measures would probably enhance the office's role of serving as an evaluative check on the programs of the other NIE offices. The Office of Education R&D's independence would, however, clearly be relative, since the NIE management would not relinquish all controls. The influence of the panels could be limited by not using the project selection procedure of having them assign numerical scores to project proposals and awarding grants in the order of these scores.

The Office of Experimentation and Innovation could use a modified form of the directive style. A more directed management style is chosen so that the center could concentrate its attention on a few most promising lines of development. Especially with the great involvement of the centers in community programs--in addition to the normal pressures in practice-oriented R&D--there would probably be a tendency for the centers' programs to fragment into a large number of unrelated projects. The directive management style could be used to counter this tendency. The directive style could be modified principally in that detailed, multiyear program plans would not be prepared. Instead, planning would be incremental in nature but guided by long-range objectives. Another modification could be that the Policy Research Group staff members, who could fill the need in a directive management style for an intramural research capability integrated into the management process, could be provided with funds with which to award grants to extramural R&D performers. These grants could be for projects where a Policy Research Group staff

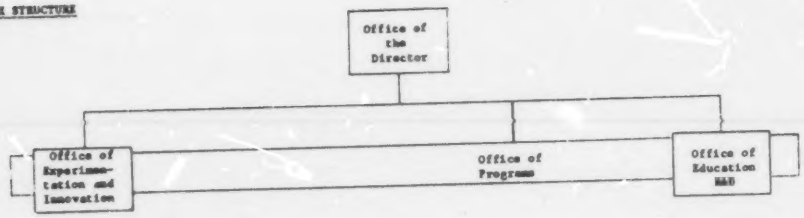
member collaborated with an extramural investigator (or investigators) to develop an idea or where an extramural performer wanted to work on problems of interest to the Policy Research Group staff member. These projects could include both fundamental research and practice-oriented R&D activities. The centers in the Office of Experimentation and Innovation could use these projects as a primary means of tapping the R&D community for ideas and information relevant to their program activities.

Another modification of the directive management style could be that each center director consults with a permanent council of knowledgeable persons from outside the NIE to advise him on the selection of large projects and the general directions of the center's program activities. Without this council, the center director's principal source of opinion would probably be the center staff, who because of the directed management style used would have substantial influence over the alternatives presented to the director.

The Office of Programs in this third model for NIE could utilize a directive management style without contradicting the specification in Strategy III to deemphasize its use, since the office is assigned only 20 percent of the NIE's budget and the other major units of the NIE use other management styles in managing R&D. The Office of Programs could use the same management plan as the Directorate of Programs in Model II. This plan is presented in Table 15. There are no special features that need to be added or modified.

Fig. 7--Model III: Support Disciplined Change

ORGANIZATION: MATRIX STRUCTURE



ACTIVITIES

Office of Experimentation and Innovation:
- Sponsor extramural practice-oriented R&D, especially experimental interventions.
- Sponsor extramural R&D in the education sciences.
- Conduct intramural research.
- Provide subject matter expertise and manpower to the other NIE offices, including the Office of the Director.

Office of Programs:
- Influence formation of national education policy.
- Conduct policy studies.
- Allocate R&D resources to divisions.
- Evaluate NIE programs.
- Advocate for changes in education and educational R&D.
- Generate ideas and plan for new NIE programs.
- Perform other administrative support functions.

Office of Education R&D:
- Manage programs to solve important national programs.
- Manage interventions successfully developed by the Office of Experimentation and Innovation.

Office of Education R&D:
- Sponsor extramural research in the education sciences.
- Sponsor extramural practice-oriented R&D.
- Sponsor the training of education R&D manpower.
- Support a number of R&D institutions.
- Conduct R&D that serves as a check on activities supported by the Office of Experimentation and Innovation.

	Percent of the NIE Budget Expended on Extramural Activities				Total
OBJECTIVES					
Problem-solving	--	--	20%	--	20%
Practice-oriented R&D	35%	--	--	15%	50% (55%)[a]
Fundamental research	1%	--	--	9%	10% (15%)[a]
Policy research	--	--	--	--	-- (5%)[a]
Manpower improvement	--	--	--	5%	5%
Institutional development	--	--	--	15%	15%
Total	36%	--	20%	44%	100%
DIVISION STAFF, PROFESSIONAL[**]					
Intramural research	132	52	--	--	184
Extramural management	228	39	40	125	422
Total	360	91	40	125	606
MANAGEMENT STYLE	Modified Directive	--	Directive	Modified Interventionist	

[a] Figures in parentheses include 5 percent institutional support.

[**] Based on a total extramural budget of $300 million.

Table 19

DETAILED PLAN FOR THE OFFICE OF THE DIRECTOR

ORGANIZATIONAL STRUCTURE

The Office of the Director would consist of five principal offices: the Office of Evaluation, the Office of Planning and Budgeting, the Office of Policy Studies, the Office of External Relations, and the Office of Administrative Services.

ACTIVITIES

Office of Planning and Budgeting
- Prepare long-range budget plans for NIE.
- Conduct program budgeting analyses.

Office of Evaluation
- Organize and manage comprehensive evaluations at approximately five-year intervals of each Center in the Office of Experimentation and Innovation, and each program in the other major units. The purpose of the evaluations would be to assess progress and to recommend changes of direction and management.

Office of Policy Studies
- Assist the Director in advising NIE on the implications of R&D for educational policy.
- Generate ideas for new NIE programs, particularly for the Office of Programs.
- Prepare initial plans for these new programs.
- Conduct all activities under Objective V (policy studies).

Office of External Relations
- Organize constituency support for selected NIE programs.
- Organize constituency support to change selected NIE programs.

STAFFING PLAN

Director of NIE
Salary: Executive Level V.

Deputy Director
Salary: GS-18 equivalent.

Director, Planning and Budgeting
Salary: GS-17 equivalent.
Background in policy analysis and program budgeting.

Planning and Budgeting Staff
Salary: GS-12 to GS-16 equivalent.
Total of ten permanent professionals on the staff.
Background in program budgeting and/or education R&D.
Other staff "matrixed" from the Office of Experimentation and Innovation.

Director, Evaluation
Salary: GS-17 equivalent.
Background in government R&D budgeting, for example, the Office of Science and Technology or the Office of Management and Budget.

Evaluation Staff
Salary: GS-15 to GS-17 equivalent.
Total of four on the staff.
Experience in organizing program evaluations, for example, as an Executive Secretary in the National Academy of Sciences.

Director, Policy Studies
Salary: GS-17 equivalent.
Background in research and policy analysis.

Deputy, New Programs
Salary: GS-16 equivalent.
Organize and manage initial planning of new NIE programs.

Policy Studies Staff
Salary: GS-12 to GS-16 equivalent.
Approximately 50 permanent professionals on the staff.
Approximately 75 other professionals "matrixed" from Policy Research Groups of the Office of Experimentation and Innovation.

Director, External Relations
Salary: GS-17 equivalent.
Background in law or educational politics.

External Relations Staff
Salary: GS-12 to GS-16 equivalent.
Total of ten permanent professionals on the staff.
Total of approximately 30 staff "matrixed" from the Office of Experimentation and Innovation.

MANAGEMENT PLAN

Program Planning
Long-range budget plans would be prepared for the Director based on program budgeting analyses.

Program Evaluation
A variety of methods would be used to evaluate NIE activities: ad hoc peer committees managed by the NIE, contracts with research institutes and firms, or reviews run by an independent agency.

Program Planning
Policy study needs would be determined by the NIE Director and the Director of Policy Studies.

The policy studies activities of the office would suggest ideas for new, NIE-directed programs. Generation of these ideas would be encouraged and developed through initial stages of planning by the Deputy for New Programs.

The NIE Director would decide which programs to transfer to the Office of Programs.

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[a] The Office of Administrative Services would not be directly involved with the substance of NIE programs and, therefore, will not be described in detail on this table.

Table 20

DETAILED PLAN FOR THE OFFICE OF EXPERIMENTATION AND INNOVATION

ORGANIZATIONAL STRUCTURE

The Office of Experimentation and Innovation would consist of four or five centers. Each center would have responsibility for conducting practice-oriented R&D in an assigned subject area. Within this subject area, the center would develop a number of related programs. Each center would consist of three groups: an Experiment Organization and Design Group, a Policy Research Group, and an Evaluation Group.

ACTIVITIES

Experiment Organization and Design Group

- Sponsor demonstration projects proposed by practitioners, researchers, and others. Successful projects would be developed as center programs.
- Design and sponsor a cumulative sequence of experiments and demonstrations to test and develop new approaches to education.
- Organize constituency support for these experiments and demonstrations.

Policy Research Group

- Conduct policy studies pertinent to the center's assigned subject area, as a source of program ideas.
- Sponsor and manage evaluative research projects to synthesize research results and identify concepts ready for experimental development.
- Sponsor extramural fundamental research and practice-oriented R&D projects as a means of linking with the education R&D community.
- Conduct intramural research and policy studies related to the center's subject area.

Evaluation Group

- Design and manage evaluation of experiments and demonstrations conducted by the Experiment Organization and Design Group.
- Three kinds of evaluations might be supported: impact, formative, and summary.[a]
- Design and manage evaluations of natural experiments.

PERFORMING COMMUNITY

Experiments and demonstrations would be performed by a wide variety of private firms, R&D institutions, education agencies, ad hoc consortia, or other public organizations.

Sponsored R&D activities would be conducted mostly by university faculty, nonprofit research institutes, and research firms.

Evaluations would be performed mostly by nonprofit research institutes and research firms.

STAFFING PLAN

Assistant Director, Office of Experimentation and Innovation
- Salary: GS-18 equivalent.
- Background in policy research and program management.
- Allocates office budget ($108 million) to the centers.

Center Director
- Salary: GS-17 equivalent.
- Total of four or five in the office.
- Allocates center budget ($22 million) to groups.
- Approves all projects over a specific amount, for example, $200,000.

Center Advisory Council
- Salary: Per diem pay plus travel expenses.
- Total of five to ten members from outside the NIE.

Planning and Management Staff
- Salary: GS-12 to GS-13 equivalent.
- Total of eight in each center.
- Staff director has salary at GS-15 level.
- Some staff have a background in program budgeting, some have a background in contracting and program management.
- Responsible for preparing an annual statement of R&D objectives.

Director, Experiment Organization and Design Group
- Salary: GS-16 equivalent.
- Background in research, law, social organizing, or educational politics.

Design Staff
- Salary: GS-12 to GS-15 equivalent.
- Total of eight in each center.
- Experts in experimental design.

Management Staff
- Salary: GS-12 to GS-15 equivalent.
- Total of 22 in each center.
- Staff members are expert in political and educational organizing, community relations, educational practice, or project management.
- Some staff also work for the Deputy Director for External Relations in the Office of the Director.

Director, Policy Research Group
- Salary: GS-16 equivalent.
- Background in policy research.

Policy Research Staff
- Salary: GS-12 to GS-15 equivalent.
- Total of 20 in each center.
- Background in research and/or policy analysis.
- Most staff also work for the Deputy Director for Policy Studies in the Office of the Director.

Director, Evaluation Group
- Salary: GS-16 equivalent.
- Background in research and program management.

Evaluation Staff
- Salary: GS-12 to GS-15 equivalent.
- Total of 20 in each center.
- Staff members are expert in survey research, evaluation design, or a subject matter area.
- Most staff are capable as project managers.

Analysis Staff
- Salary: GS-12 to GS-15 equivalent.
- Total of ten in each center.
- Staff members are expert in statistical analysis or policy analysis.
- Some staff also work for the Office of Planning and Budgeting.

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[a] In general, an impact evaluation assesses the extent to which an experimental design or program is implemented as intended; a formative evaluation diagnoses factors explaining why an intervention is or is not working; a summary evaluation assesses the educational effect of an intervention.

Table 20 (Continued)

Programs within a center would be staffed from the three groups. Two program co-managers would be appointed; one managing program staff from the Experiment Organization and Design Group and one managing program staff from the Evaluation Group. Staff from the Policy Research Group would work with both program staff groups.

Overall direction for all programs would be provided by the Center Director.

Programs would not be formally designated as organizational units within a center; they would exist only as informal working groups.

MANAGEMENT PLAN

Program Planning

The Planning and Management Staff would annually prepare a statement of program objectives for a center. These objectives would be broadly stated; a detailed, written plan for developing a center's programs would not be produced. A center's objectives would be reviewed annually by the Center Advisory Council.

The center's program development strategy would be, in general, to begin with a basic idea and develop it into an effective educational improvement through a cumulative, coordinated sequence of educational demonstrations and experiments. In the early stages of development, these programs would be individual, or at most a few demonstration projects. After an initial period of adjustment and redesign, programs would grow gradually in size and eventually include more rigorously evaluated experiments at multiple sites. Programs that proved effective would be transferred to the Office of Programs to be refined and replicated at a larger number of sites. Eventually, the program would be transferred to another educational agency.

Program ideas would originate in all three staff groups: in the Experiment Organization and Design Groups from demonstration projects proposed by the practitioners and others, in the Research Group from policy study results and from contacts in the education R&D community, and in the Evaluation Group from the out come of formative and summary evaluations conducted by the group.

Program Development

Project Generation. Some demonstrations would be proposed by practitioners and others outside the NIE and submitted for funding. Others would be initiated by Experiment Organization and Design Group staff.

Most demonstrations would be suggested by the outcomes of preceding demonstrations or experiments.

Demonstrations and experiments would be supported by either grants or contracts, as desirable.

Project Selection. The Planning and Management staff would convene ad hoc panels of NIE staff to evaluate project proposals.

Projects over $200,000 would be selected by the Center Director; under $200,000, by the Design Group Director.

Projects over $200,000 would be reviewed by the Center Advisory Council.

Project Monitoring. Each project would be carefully monitored for substantive progress and given technical assistance and instructions by the NIE staff.

Project Evaluation. Policy Research Group staff and Design Group staff would study all project outcomes to understand the implications of the results for future projects.

Program Development

Project Generation. Policy Research Group staff would generate their own intramural projects.

Most Policy Research Group staff members would also support a number of extramural investigators working in the staff members' special area of interest. These grants would be used as a means of tapping the R&D community for ideas and information.

Project Selection. All projects would be approved by the Policy Research Group Director.

Project Monitoring. Most of the Policy Research Group staff would travel extensively in the R&D and practitioner communities to keep abreast of progress and exchange information.

Program Development

Project Generation. Policy Research Group staff or evaluation staff would suggest natural experiments that should be evaluated.

All experiments supported by the Experiment Organization and Design Group would be evaluated.

Analysis of evaluations would suggest further evaluation projects.

All evaluations would be performed by a competitively selected contractor.

Project Selection. The Planning and Management Staff would convene an ad hoc panel of the NIE staff for each evaluation project. The panel would review the project Request for Proposals (RFPs) and select bidders in the "competitive range."

All RFPs over $200,000 would be reviewed by the Center Advisory Council.

The Center Director's approval would be required for all RFPs, and he would select the best contractors.

Project Monitoring. Same as Experiment Organization and Design Group.

Project Evaluation. All completed evaluation projects would be studied by the Analysis Staff of the Evaluation Group.

Program Evaluation

Each center's programs would be rigorously evaluated every five years by the Office of Evaluation in the Office of the Director.

Annually, the center staff would present a review of the center's programs and plans for the next year to the Center Advisory Council. The council would critique the progress reports and program plans.

Table 21

DETAILED PLAN FOR THE OFFICE OF EDUCATION R&D

ORGANIZATIONAL STRUCTURE

The Office of Education R&D would consist of three centers: the Division for Education Foundations, the Division of Education Practice, the Division of Institutional Resources. Each division (except perhaps the last) would consist of a number of programs. Each program would support a number of extramural research projects.

ACTIVITIES

Division of Education Foundations
All activities under Objective I would be supported.

Division of Education Practice
All activities under Objective II would be supported.

Division of Institutional Resources
R&D institutional development (Objective VII) and R&D manpower improvement (Objective VI) would be the principal activities.

PERFORMING COMMUNITY

Multiyear grants would be awarded to individuals and to teams of performers.
Almost all of the performers would be located in universities.

Multiyear grants and contracts would be awarded to individuals and to teams of performers.
Approximately one-half of the performers would be from universities. The remainder would be from R&D firms and education agencies.

Institutional support (see Objective VII) would be given to a few R&D centers located across the country.
Most centers would be collocated with a university.

STAFFING PLAN

Assistant Director, Office of Education R&D
Salary: GS-18 equivalent.
Recognized accomplishments in research and R&D management.
Allocates the office's budget to the divisions.

Division Director, Education Foundation
Salary: GS-17 equivalent.
Recognized accomplishments in research.
Allocates division budget ($24 million) to five programs.

Deputy Division Director, Planning
Salary: GS-16 equivalent.
Background in program and policy analysis.
Coordinates with Policy Research Directors in the Office of Experimentation and Innovation.

Program Director
Salary: GS-16 equivalent.
Total of five in the division.
Background in research and program management.
Manages a team of five Associate Program Directors.

Associate Program Directors
Salary: GS-15 to GS-16 equivalent.
Total of 25 in the division.
Manage R&D activity in an assigned subject area.

Review Panels
Salary: Per diem plus travel expenses.
Total of 12 panels in the division.
Experience in education research.
Consultants to the Associate Program Directors in evaluating the division's programs and selecting projects.

Executive Assistants
Salary: GS-11 to GS-12 equivalent.
Total of five or six in the division, one for every two review panels.
Responsible for handling the business affairs of the review panels.

Division Director, Education Practice
Salary: GS-17 equivalent.
Recognized accomplishments in R&D management.
Allocates division budget ($45 million) to six programs.

Deputy Division Director, Planning
Salary: GS-16 equivalent.
Background in program and policy analysis.
Coordinates with Policy Research Directors in the Office of Experimentation and Innovation.

Program Director
Salary: GS-16 equivalent.
Total of six in the division.
Background in R&D program management.
Manages a team of eight Associate Program Directors and a planning staff.

Associate Program Directors
Salary: GS-15 equivalent.
Total of 48 in the division.
Manage R&D in an assigned subject area--areas overlapped to facilitate interaction.

Planning Staff
Salary: GS-13 to GS-14 equivalent.
Total of two per program.
Background in research and/or resource allocation analysis.
Reports to Deputy for Planning.

Review Panels
Salary: Per diem plus travel expenses.
Total of 24 panels in the division.
Experience in educational research or practice.
Consultants to the Associate Program Directors in evaluating the division's programs and selecting projects.

Executive Assistants
Salary: GS-11 to GS-12 equivalent.
Total of 11 or 12 in the division, one for every two review panels.
Responsible for handling the business affairs of the review panels.

Division Director, Institutional Resources
Salary: GS-17 equivalent.
Determines budgets for the R&D centers.

Centers Program Manager
Salary: GS-15 to GS-16 equivalent.
Total of six in the division.
Responsible for managing the centers' programs.
Coordinate with the Deputy Division Directors for Planning.

Training Program Manager
Salary: GS-15 to GS-16 equivalent.
Total of three in the division.
Responsible for managing the training program.
Coordinate with the Program Directors in the divisions.

Table 21 (Continued)

MANAGEMENT PLAN			
	Program Planning A statement of broad research priorities, especially new initiatives needed, would be prepared annually by the Planning Deputy. Associate Program Directors would implement the plan by recruiting researchers	**Program Planning** Each program would prepare a statement of its objectives annually, some in specific terms and some in general terms. Program plans would be implemented by disseminating R&D objectives and recruiting R&D performers in priority areas.	**Program Planning** The Division Director would work with Planning Deputies of the other divisions to determine what new centers are needed and what the priorities for existing centers should be. Needs for training projects would be determined by the other divisions.
	Program Development Project Generation. Project ideas would be generated by individual researchers and submitted for funding. Project Selection. Associate Program Directors would meet twice a year with one of the review panels to discuss which proposals should be funded. Associate Program Directors would then select the proposals to be funded.	**Program Development** Project Generation. Performers would generate project ideas which respond to the R&D objectives and submit them for funding. Project Selection. Associate Program Directors would meet twice a year with one of the review panels to discuss which proposals should be funded. Associate Program Directors would then select the proposals to be funded. Project Monitoring. Selected projects would be closely monitored for substantive progress.	**Program Development** Project Generation. Center Program Directors would organize the nucleus of new R&D centers. Training projects would be stimulated by Program Directors in the other divisions to meet their priority needs. Others would be submitted unsolicited. Project Selection. Center budgets would be established triannually by the Division Director. All training proposals with a chance for funding would be sent to mail reviewers. The Training Program Directors would determine the list of projects to be supported but respond to the needs stated by the other divisions.
	Program Evaluation Program activities would be evaluated periodically (for example, every five years) by the Office of Evaluation in the Office of the Director.	**Program Evaluation** Program activities would be evaluated periodically (for example every five years) by the Office of Evaluation in the Office of the Director.	**Program Evaluation** Each center would be rigorously evaluated every two years. The division would utilize site-visiting panels of researchers and management experts. Training activities would be evaluated periodically by the Office of Evaluation in the Office of the Director.

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ADDENDUM:

ALTERNATIVE DESIGNS FOR THE NATIONAL INSTITUTE OF EDUCATION

John Wirt

These pages replace pgs. 33 (bottom) through 49 (top) of Rand Working Note WN-7793.

PLANS FOR ORGANIZING THE R&D PERFORMER COMMUNITY

The final basic element of the NIE's design is a plan for organizing the R&D performer community for maximum effect on educational practice. Studies of R&D suggest that R&D organizations have to make four basic choices in deciding how to organize their performer communities.

1. How will high technical quality be ensured in the R&D conducted?
2. How will the educational R&D conducted be made relevant to practice?
3. How will the R&D results achieved be translated into changes in educational practice?
4. How will constituency support for R&D be established in the user and the R&D communities?

The model behind these choices is that educational R&D will have a net effect on educational practice in proportion to its technical quality, relevance, utilization in practice, and amount of public support. Public support certainly will be contingent on the demonstrated technical quality, relevance, and use made of the educational R&D supported by NIE, but this demonstration will probably require a long period of time. In the meanwhile, direct steps to build public support for educational R&D can be taken.

As employed here, the term "technical quality" means, in a general sense, the magnitude of the increase in technical knowledge and capability produced by an R&D achievement, disregarding its potential or actual effect on practice. Using an economist's jargon and concepts loosely, the increase in technical quality produced by an R&D achievement is the amount by which it "moves the educational production function outward." Both scientific advances in pure understanding and educational developments qualify as increases in technical quality. The term "technical rigor," which is sometimes used synonymously with technical quality, describes instead a means to achieving higher technical quality.

"Relevance" is more simply defined as the potential that an R&D achievement has for affecting educational practice. Thus, an educational achievement can represent a sizeable increase in technical quality without being very "relevant" to educational practice.

Each of the four choices above can be made in a number of ways. Thus, there are in theory a large number of plans for organizing the R&D performer community. The number can be reduced, however, by selecting a few that are judged most distinct from each other and that are apparently useful in educational R&D.

No single plan can be presented as superior, for there are many reasons for and against each of the ways of making the four basic choices and very little consensus on which of these reasons are most important in educational R&D. These different ways of making the four basic choices represent, in effect, different schools of thought on what should be emphasized in organizing the R&D performer community. Each school accepts an internally consistent system of beliefs and acts accordingly, but the beliefs of one school conflict with the beliefs in the other schools. This is an important point, for there are numerous apparent conflicts in deciding how to organize the R&D community. Formulating these conflicts as choices emphasizes clearly that there is no single best way to resolve them. Either explicitly or implicitly, the NIE will have to make its choices without being able to utilize many scientific findings. Some possible ways of making these choices are discussed in the following subsections.

Achieving R&D of High Technical Quality

One way (or policy) that could be used to achieve high technical quality in conducting R&D would be for NIE managers to concentrate on building strong peer groups within the educational community and to separate them institutionally from the user community. NIE managers would view their primary role as finding and developing "good people," directing groups of them into working on a limited number of "solvable" problems, and, in general, facilitating the development of interactions and cohesiveness within these groups. The managerial devices that could be employed include stressing the recruitment of highly qualified R&D performers from all disciplines into educational R&D, running

frequent workshops to bring members of the group together to work on issues, fostering collaborative research, coupling R&D training closely to specific research projects, using peer panels for many R&D management tasks, and so on. The NIE would rely on the peer groups through their usual methods* as the primary means of establishing and enforcing high technical standards of R&D performance.

These peer groups would also be considered the most effective way of generating fundamentally new ideas for education, and these ideas would be considered essential for ultimately achieving significant improvements in educational practice. It would be believed that most of these ideas have been tried and seem to make little difference.**

A second policy choice would be for NIE to concentrate on identifying technically significant educational R&D that should be done and give little direct concern to building strong peer groups in the R&D performer community. Instead, R&D performers would be found largely on a project-by-project basis both by solicited and unsolicited methods. The belief would be that peer groups could not be made strong enough in educational R&D in the near future to set high enough technical standards with sufficient uniformity. High technical standards would be established internally and enforced externally by evaluating carefully prepared project plans. Many pilot studies would be funded as the principal means of supporting R&D performers to develop these detailed project plans.

Under this second policy, NIE would believe that a broad knowledge base is essential to long-run success in solving educational problems, but would believe that enough is already known to enable solutions of sufficiently high technical quality to be found now to these problems. Therefore, less emphasis would be placed on the primacy of generating fundamentally new, educationally relevant ideas as necessary for solving significant practical problems.

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*W. O. Hagstrom, *The Scientific Community*, Basic Books, New York, 1965.

**H. A. Averch, S. J. Carroll, T. S. Donaldson, H. J. Kiesling, J. Pincus, *How Effective is Schooling?--A Critical Review and Synthesis of Research Findings*, The Rand Corporation, R-956-PCSF/RC, March 1972.

A third policy could be to put less emphasis on the need for research knowledge as a prerequisite for important advances in educational R&D and to rely more on supporting clever inventors working in an actual educational environment to achieve significant educational advances. Adoption of this policy would follow from the observation that significant change in education can occur without waiting for the results of R&D, as it has in many other fields.* The intuitive creators among educational practitioners and others have produced many educational innovations and more will appear with or without the basic understanding that can only be provided by R&D. Many of these innovations have been put into widespread practice, but often they have been adopted without an adequate understanding of their long-term effects or their relationship to educational goals. This lack of understanding leads to perpetual change without improvement, and can often result in difficulties in replication. A principal role for educational R&D in this policy, then, would be to discipline the inventors and the change process by evaluating which innovations produce valid improvements. Three means of establishing this discipline would be used. First, some R&D would be merged with the invention and change process by having high-quality researchers teamed with inventors in the design phases, creating educational improvements to inject the findings of research into the invention process. And, second, educational improvements would be subjected to rigorous evaluative research throughout the time of their development. Both of these means would have the effect of eliminating much of the institutional separation between the R&D community and the user community that would occur with the first two policies. The result would be what might be called a sizeable component of "action research" in the R&D performer community--R&D performers working with inventors in the user community. A third means of enforcing discipline on the inventive activity would be for NIE to support a sizeable component of more conventional R&D as a source of criticism and ideas for the inventive

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*A.R.J.P. Ubbelohde, "The Beginning of Change from Craft Mystery to Science as a Basis for Technology," Charles Singer, et. al. (eds.), *A History of Technology, Vol. IV, The Industrial Revolution, c. 1750 to c. 1850*, Oxford University Press, 1958; D. J. deSolla Price, "Is Technology Historically Independent of Science?" *Technology and Culture*, Vol. 6, Fall 1965; and J. Ben-David, "Roles and Innovations in Medicine," *American Journal of Sociology*, Vol. 65, May 1960, pp. 557-568.

Table

SUMMARY OF PLANS FO

	Plans for Organizing
Choices	Build R&D Resources
Achieve R&D of high technical quality.	Build strong peer groups in the R&D performer community. Rely primarily on peer group processes for generating project ideas and setting technical standards of performance. Emphasize the importance of generating fundamentally new ideas to being able to achieve significant improvements in educational practice.
Conduct relevant R&D	Institutionalize interactions between the peer groups in the R&D community and users in judiciously chosen ways.
Implement the results of R&D	Build a single institutional network in the user community for connecting the R&D and user communities.
Build constituency for R&D	Do not advocate an approach to solving an educationa problem until R&D performers are agreed on its merit. Distribute R&D resources regionally in the form of institutional grants.

Table 8

SUMMARY OF PLANS FOR ORGANIZING THE R&D PERFORMER COMMUNITY

Plans for Organizing the R&D Performer Community		
uild R&D Resources	Produce R&D Results	
ng peer groups in the R&D performer y. Rely primarily on peer group s for generating project ideas and technical standards of performance. the importance of generating fundamentally s to being able to achieve significant ents in educational practice.	Identify technically significant educational R&D internally to the NIE. Find performers for this R&D in the external performer community. Enforce high technical standards externally by carefully evaluating detailed project plans. Undertake solving practical problems immediately, assuming that enough knowledge is available.	Rely h inve tion know to b Discip ject rese supp subj
nalize interactions between the peer n the R&D community and users in sly chosen ways.	Detect and diagnose problems in the user community Analyze and plan for the knowledge, development, and reform needed to resolve the problem. Allocate tasks to the R&D performer community.	Suppor larg tion In int obje resu ed. Use R& proc and
ngle institutional network in the user y for connecting the R&D and user com- .	Use a variety of mechanisms for linking R&D R&D with users and for linking users with R&D. Use the best mechanism for each kind of situation.	Contin tion repl deve Use ot
ocate an approach to solving an educationa until R&D performers are agreed on its R&D resources regionally in the form of ional grants.	Do not advocate an approach to solving a problem until R&D performers are agreed on its merit. Announce a strong NIE commitment to directly solving practical problems.	Organi to s befo Announ solv

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ORGANIZING THE R&D PERFORMER COMMUNITY

the R&D Performer Community	
Produce R&D Results	Support Disciplined Change
Identify technically significant educational R&D internally to the NIE. Find performers for this R&D in the external performer community. Enforce high technical standards externally by carefully evaluating detailed project plans. Undertake solving practical problems immediately, assuming that enough knowledge is available.	Rely heavily upon intuitive and creative inventors for achieving significant educational developments, assuming that a broad knowledge base is not needed for invention to be successful. Discipline the inventive process (1) by subjecting creations to rigorous evaluative research, and also (2) by independently supporting conventional R&D in the same subject areas.
Detect and diagnose problems in the user community Analyze and plan for the knowledge, development, and reform needed to resolve the problem. Allocate tasks to the R&D performer community.	Support a cumulative sequence of increasingly larger, experimental, educational interventions as the principal innovative activity. In intervening, be guided by long-range objectives, but plan incrementally based on results achieved and opportunities encountered. Use R&D to guide the invention and change process toward the areas of greatest need and opportunity.
Use a variety of mechanisms for linking R&D R&D with users and for linking users with R&D. Use the best mechanism for each kind of situation.	Continue enlarging the sequence of interventions, but shift from experimentation to replication in the mature (later) stages of development. Use other means as needed.
Do not advocate an approach to solving a problem until R&D performers are agreed on its merit. Announce a strong NIE commitment to directly solving practical problems.	Organize the R&D performer and user communities to support an experimental intervention even before it is proved. Announce a strong NIE commitment to directly solving practical problems.

activities. To ensure the independence of this criticism and these ideas, this conventional R&D activity would be organizationally insulated from the rest of NIE's activities. The principal distinctions of this policy for obtaining educational R&D of high technical quality is to allow the ideas and insights of inventors to be a principal directional guide for the NIE's activities, but to discipline this process by exposing its products to various forms of independent analysis. This is almost the reverse of the linear model of the R&D process where research leads to development which leads to implementation.

Each of these three policies for achieving R&D of high technical quality is summarized in Table 8. The choices are listed under one of three plans for organizing the R&D performer community. These plans will be completed by specifying policies for the three other choices involved in a plan for organizing the R&D performer community.

It should not be inferred from this discussion that choosing one policy precludes even partial use of any of the alternative policies that could have been chosen. On the contrary, in implementing any plan, some policies of the other plans would probably be adopted to some extent.

This analysis deals with what could be emphasized in a plan in distinction to the other plans. For example, in the second policy discussed above, technical standards are set by evaluating carefully prepared project plans. Any organization adopting this policy would, to some extent, also follow the first policy of building peer groups within the R&D community, but would not consider it as important a means of ensuring technical quality as evaluating carefully prepared project plans. Procedures for implementing these emphases are presented in Sections III through V.

Increasing the Relevance of R&D

One policy that could be followed to increase the relevance of the R&D conducted to the problems of users would be to institutionalize appropriate interactions between (peer) groups in the R&D community and the user community or representatives from the user community at judiciously selected points. This could be accomplished partly by building strong R&D institutions in all subject areas important to education and by linking these institutions with each

other, with the users of R&D, and with R&D performers outside the institutional network. This network of R&D institutions, which could undertake a range of activities from fundamental research to implementation, would be viewed by the NIE as the core of the educational R&D community.

Another means of providing contact between different groups could be to sponsor conferences and workshops structured to fill selected needs. Other means could also be used.

A second policy for increasing the relevance of R&D activities would be for the NIE to assume major responsibility for detecting and diagnosing educational problems and for guiding and frequently directing the educational R&D community into working on these problems. A multiple partnership would be visualized: The NIE would analyze problems and allocate tasks to the R&D performer community; the R&D community would perform these tasks; and the practitioner community would implement the results of R&D.

A third policy for increasing the relevance of R&D is compatible with the third policy for achieving high technical quality improvements through R&D. A likely approach would be to spend a substantial portion of R&D resources on experimental, educational interventions in actual environments. These interventions would be staged to proceed from small-scale, conceptualizing activities at one site to increasingly larger, more comprehensive activities at numerous sites. Each site would have its own R&D component. Adjustments based on both intuition and quantitative measurement would be made iteratively at and during each stage to improve the effect of the intervention. The precision of measurement might be weak at first, but would become increasingly refined in the later stages of development. Many of these sites would, in turn, be multiplied to stimulate further disciplined change and continually improve the effect of the intervention.

The NIE would believe that the data produced by these experimental activities is less important than the experiences and subjective knowledge gained by those conducting the activities. These personnel would use their experiences and subjective knowledge to suggest improvements in the intervention and to train others in its application.

Data would be considered important for preventing unwarranted conclusions from being drawn from the intervention activities.

In the mature or later stages of development of an intervention, reducing the operating cost and increasing the transferability of an intervention would be increasingly important objectives. An entire development sequence would be expected to take 10 years or more in a typical case, and great effort would be exerted to support an intervention through difficult periods.

Program planning would be characteristically incremental and not elaborate. Hierarchies of objectives would not be formulated to rationalize programs. Broad objectives would be stated and understood as general directions for R&D activities, but planning within these objectives would be incremental from year to year. The successes and failures of the past year's activities, in addition to new opportunities, would suggest shifts in emphasis and tactics for the next year. These three policies are also summarized in Table 8.

Implementing R&D Results

The next choice in planning the organization of the R&D community --a policy for implementing R&D results--will be treated briefly, since this study is primarily concerned with the organization and management of R&D and not the conversion of R&D results into widespread educational change.

One possible policy would be to spend most of education's resources for implementation on a single, large, institutional infrastructure that links practitioners and other users with R&D. The system would have to be complex and comprehensive to connect completely with the widely distributed and highly varied educational system. The extension agent system developed by the Department of Agriculture is a good example of an implementation system consistent with this policy.

Another policy could be to emphasize the need for a variety of often institutionally separate linkage mechanisms in both directions between the R&D community and the user community. Linkages would be considered necessary in one direction to distribute the products and

knowledge gained from R&D to the user community. Linkages would be considered necessary in the other direction to obtain feedback on the effectiveness of solutions made available to the user community and to keep informed of actual problems there. There would be a strong emphasis on the need to have a great variety of linkage and implementation mechanisms on hand so that the best mechanism would be available for each kind of situation. Many of these mechanisms would only be used temporarily.

A third policy for implementation is a natural extension of the third policy for increasing the relevance of R&D. The R&D approach of staging a multiplicative sequence of experimental interventions could in time lead to implementing the experimental interventions as local practices at a large number of sites across the country. To an increasing degree, these later-generation sites could become parent sites (or centers) for organizing and managing the replication of the intervention at other sites near and similar to the parent sites.

Building Constituency for R&D

The policy used to build constituency for R&D is an extremely important and complicated one for the NIE to consider, but only three aspects will be considered here. Other aspects of a policy for building constituency should be carefully studied by the NIE, especially through careful examination of policies that other R&D organizations have followed.

One aspect is whether or not an approach to an R&D program will be advocated vigorously in the R&D performer and user community before R&D has proven the worth of the approach.* As used here, advocacy refers to a limited range of activities: actions undertaken to organize support in the user community and also in the R&D performer community in favor of a particular program approach *before* the R&D community has reached full consensus that the approach is a good one.

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* E. R. House, *The Development of Educational Programs, Advocacy in a Non-Rational System,* Center for Instruction and Curriculum Evaluation, November 1970.

The traditional norm in the R&D performer community is strongly against advocacy because of the pressures it usually generates to cut corners in the design of R&D projects.

The question of whether or not to emphasize advocacy is most important when conducting experimental interventions in actual educational environments. In running a voucher experiment, for example, the traditional R&D position would, in simplified terms, be strongly in favor of random selection of a site for the experiment, unobtrusively measuring the pretest conditions, setting up an office to distribute vouchers and then measuring post-test conditions, all without other exogenous influences of the federal government. Conversely, the advocate's position would be to do some preliminary organizing to find sites where there was greater potential support for the intervention, choose the sites with the greatest likelihood of initial success, and then work with R&D and user community groups before and during the intervention to organize more support for it. The advocate's belief is that although his activities may sometimes force a sacrifice in experimental design, the gain in support to continue the experiment will more than compensate for the loss.

Any program, of course, will be a compromise between these two positions. But, where the balance is struck--on the side of advocacy or on the side of pure experimental design--determines whether or not an advocacy policy will be chosen.

Because of their background and training, few R&D performers will excell in the advocate's role; thus, the NIE would need to employ personnel with non-R&D backgrounds to ensure favoring a policy of advocacy over one of "pure" experimental research. Backgrounds that are more likely to be appropriate are law, politics, and community organization.

Another aspect of constituency building is the extent to which R&D support is distributed regionally in some form of an institutional grant. The experience of several R&D agencies is that a sizeable institutional grant program on a national scale apparently causes strong constituency support from users and other political sources.

A third aspect of constituency support especially in the current political climate for R&D is size of the commitment announced to solving important, practical education problems.

Summary

All the policies discussed above are grouped in Table 8 under three plans for organizing the R&D performer community. The policies have been selected in each plan to reinforce one another so that the combination of the policies produces plans that are maximally distinct and internally consistent.

Build R&D Resources. The first plan, which will be called the Build-R&D-Resources plan, uses the first policy for each of the first three choices outlined above and the non-advocacy and institutional grant policies for the fourth choice. The common theme among these policies is to improve the process by which educational R&D is conducted. These means of improving the process include improving the quality of personnel performing educational R&D, improving the pattern of interactions among them, and improving the system of R&D institutions. With this plan, NIE management would view its primary purpose as building a reservoir of knowledge, ideas, and products useful in improving education. NIE management would not be primarily and directly concerned with the exact substance of R&D on a project-by-project basis. Instead, NIE managers would focus on improving the infrastructure for conducting educational R&D in such ways that the resources available from the educational R&D community are more extensive and useful to others. The NIE would believe that the primary concern of R&D management should be personnel and institutional development rather than the particular problems solved and the R&D results obtained.

Of the existing agencies, this plan is followed partly by the National Institute of Dental Research and the National Institute of Child Health and Human Development in the National Institutes of Health, and more closely by the Department of Agriculture's Cooperative State Research Service, which manages the State Agricultural Experiment Stations.

Produce R&D Results. The second plan, which will be called the Produce-R&D-Results plan, uses the second policy for each of the first three choices discussed above and the non-advocacy and problem-solving policies for the fourth choice. The common theme among these is an orderly approach to R&D management and organization where the NIE would, to a much greater extent than in the first plan, control the substance of R&D and be directly concerned with its effectiveness in producing results useful to educational policymakers and practitioners. This is an output-oriented plan compared to the first one, which is input-oriented. More precise division of tasks into subtasks would be made. To the maximum extent practicable, the progression of ideas from conception to implementation would be carefully orchestrated, with efficient allocation of resources as a primary concern. Problems would be decomposed into requirements for knowledge, development, and reform, and resources would be allocated for "maximum" payoff. Evaluating the progress of R&D programs and redirecting effort toward more promising areas of study would be important management activities. Characteristic of this plan for organizing the R&D community, the NIE would take pride in its managerial competence.

This plan is followed most closely by some industrial R&D laboratories; in government it is used by the National Aeronautics and Space Administration's Goddard Space Flight Center.

Support Disciplined Change. The third plan for organizing the R&D performer community, which will be called the Support-Disciplined-Change plan, uses the third policy for each of the first three choices and the advocacy and problem-solving policies for the fourth choice. The common theme among these policies is that the NIE would integrate the educational R&D process with the more general educational change process--a change-oriented philosophy that is neither totally output-oriented nor totally input-oriented.

This plan would be viewed as a way of coping with the extreme complexity of educational phenomena and the difficult problems of educational goals, attitudes, and local circumstances. These difficulties would be considered greater in education than in many other fields, calling for different ways of organizing the R&D community. The plan would be considered a means of leap-frogging some of these difficulties--by relying more heavily on inventive processes for NIE's

direction and creating educational advances and using R&D primarily as an evaluative check on and a guide for the inventive processes.

In our judgment, the Office of Child Development most closely follows this plan for organizing the R&D performer community.

ALTERNATIVE STRATEGIES FOR ORGANIZING AND MANAGING THE NIE

The five design elements just presented can be combined in a number of ways to generate alternative strategies for organizing and managing the NIE. Each strategy consists of a particular choice for each of these design elements:

- o A set of priorities among the R&D objectives,
- o A division of responsibility,
- o An organizational structure,
- o A management style for each major unit, and
- o A plan for organizing the R&D performer community.

Not all of the alternative strategies which can be generated, however, are compatible combinations of the elements. Many can be eliminated on reasonable grounds, leaving a limited number of combinations as attractive strategies for organizing and managing the NIE.

The determining factor in a combination of design elements is the *plan for organizing the R&D performer community*. Once this plan has been selected, only certain ways of choosing some of the other design elements are compatible with that plan.

Strategy I Based on the Build-R&D-Resources Plan

Management Styles. If NIE adopted the Build-R&D-Resources plan for organizing the R&D performer community, choosing the less-directed management styles would be more desirable than choosing the more-directed management styles. Using the less-directed management styles is congruent with the policies of building strong peer groups, relying on these peer groups to set technical standards, and building regional

R&D institutions. These policies and their implications for selecting management styles are listed in Table 8a. For example, one important way of building peer groups--attracting highly qualified R&D performers from other fields into educational R&D--would probably be much easier if NIE allows its extramural performers greater freedom to choose the substance of their work. The amount of freedom will be in inverse proportion to the control that NIE exerts over the content of R&D, or, equivalently, the directiveness of the management styles employed.

R&D Objectives. If NIE adopted the Build-R&D-Resources plan, the R&D objectives that would be emphasized are fundamental research (Objective III), R&D manpower improvement (Objective VI), and institutional development (Objective VII). Objective III would be emphasized as a primary source of fundamentally new ideas; R&D manpower improvement as a means of building R&D peer groups; and institutional development as a means of forming an infrastructure for educational R&D. Again these choices are indicated in Table 8a under the column for the Build-R&D-Resources plan. The problem-solving objective (Objective I) would be deemphasized on the grounds that the knowledge base is too weak for effective problem-solving activity (see Table 8a). The policy studies objective (Objective V) would also be deemphasized since problem-solving is deemphasized (policy studies would be a primary source of ideas for problem-solving programs) and since the less-directed management styles, which involve less concern for "optimal" resource alloration, are implied for use with the Build-R&D-Resources plan.

Organizational Structure. The implications for NIE's organizational structure of choosing the Build-R&D-Resources plan are not as strong as for management styles or R&D objectives, but the general policy of being concerned with the process by which educational R&D is conducted--the linkages among peer groups and between peer groups and users--fits well with the concept of a linked organizational structure. The mechanisms of coordination in the linked structure (collocation and use of neutral coordinators) can be

Table 8

SUMMARY OF COMPATIBLE COMBINATIONS OF DESIG

	Plans for Organizing the
Choices	Build R&D Resources
Achieve R&D of high technical quality.	Build strong peer groups in the R&D performer community. *Requires the less-directed management styles.* *Implies emphasizing the manpower training objectives.* Rely primarily on peer group processes for generating project ideas and setting technical standards of performance. Emphasize the importance of generating fundamentally new ideas to being able to achieve significant improvements in educational practice. *Implies emphasizing the fundamental research objective and, also, research within the practice-oriented R&D objective.* *Implies deemphasizing problem-solving.*
Conduct relevant R&D	Institutionalize interactions between peer groups in the R&D community and users in judiciously chosen ways. *Implies emphasizing the institutional development objective.* *Argues for using the linked organizational structure.*
Implement the results of R&D (omitted)	
Build constituency for R&D	Do not advocate an approach to solving an educational problem. Distribute R&D resources regionally in the form of institutional grants. *Implies using the decentralized style for managing extramural R&D institutions.*
Implications for Policy Research Objective	*Policy research deemphasized since (1) the less-directed management styles are implied, and (2) problem-solving is deemphasized.*
Implications for organizational structure	*Not matrix because less-directed management styles don't require ready access to a wide range of internal management and technical expertise.*

Table 8a

SUMMARY OF COMPATIBLE COMBINATIONS OF DESIGN ELEMENTS IN DESIGNING STRATEGIES FOR NIE

Plans for Organizing the R&D Performer Community		
Build R&D Resources	Produce R&D Results	
ld strong peer groups in the R&D performer ommunity. *uires the less-directed management styles.* *lies emphasizing the manpower training objectives.* y primarily on peer group processes for generating roject ideas and setting technical standards of erformance. hasize the importance of generating fundamentally ew ideas to being able to achieve significant mprovements in educational practice. *lies emphasizing the fundamental research objective nd, also, research within the practice-oriented &D objective.* *lies deemphasizing problem-solving.*	Identify technically significant educational R&D internally to the NIE. Find performers for this R&D in the external performer community. Enforce high technical standards externally by carefully evaluating detailed project plans. *Implies the more directed management styles.* Undertake solving practical, educational problems immediately. *Implies emphasizing problem-solving or practice-oriented R&D objectives.*	Re *Imp* Dis *Imp* *Num*
titutionalize interactions between peer groups n the R&D community and users in judiciously hosen ways. *lies emphasizing the institutional development bjective.* *ues for using the linked organizational structure.*	Detect and diagnose problems in the user community. Analyze and plan for the knowledge, development, and reform needed to resolve the problem. Allocate tasks to the R&D performer community. *All three entries above imply emphasizing the problem-solving objective and using the more directive management styles.*	Sup In *Impl* Use
not advocate an approach to solving an educational roblem. tribute R&D resources regionally in the form of nstitutional grants. *lies using the decentralized style for managing tramural R&D institutions.*	Do not advocate an approach to solving an educational problem. Announce a strong NIE commitment to directly solving practical problems.	Org Anno
icy research deemphasized since (1) the less- irected management styles are implied, and (2) roblem-solving is deemphasized.	*Policy research strongly emphasized to support problem-solving and the more directed management styles*	
matrix because less-directed management styles on't require ready access to a wide range of nternal management and technical expertise.	*Matrix preferred because more directive management styles require ready access to a wide range of internal managerial and technical expertise.*	

IGN EMENTS IN DESIGNING STRATEGIES FOR NIE

	R&D Performer Community	
	Produce R&D Results	Support Disciplined Change
-	Identify technically significant educational R&D internally to the NIE. Find performers for this R&D in the external performer community.	Rely heavily upon intuitive and creative inventors for achieving significant educational developments.
s. ng	Enforce high technical standards externally by carefully evaluating detailed project plans.	*Implies emphasizing practice-oriented R&D.* Discipline the inventive process (1) by evaluative research and (2) by independent R&D.
y	*Implies the more directed management styles.*	*Implies fundamental research and practice-oriented R&D should not be deemphasized.*
ive	Undertake solving practical, educational problems immediately.	*Number 2 implies dividing by R&D objectives and supporting a number of quasi-independent R&D institutes.*
	Implies emphasizing problem-solving or practice-oriented R&D objectives.	
	Detect and diagnose problems in the user community.	Support a cumulative sequence of increasingly larger, experimental educational interventions.
	Analyze and plan for the knowledge, development, and reform needed to resolve the problem.	In intervening be guided by long-range objectives, but plan incrementally.
re.	Allocate tasks to the R&D performer community.	*Implies not using the most directive management styles.*
	All three entries above imply emphasizing the problem-solving objective and using the more directive management styles.	Use R&D to guide the invention process to areas of greatest need and opportunity
nal	Do not advocate an approach to solving an educational problem.	Organize the R&D performer and user communities to support an experimental intervention.
	Announce a strong NIE commitment to directly solving practical problems.	Announce a strong NIE commitment to directly solving practical problems.
	Policy research strongly emphasized to support problem-solving and the more directed management styles	
	Matrix preferred because more directive management styles require ready access to a wide range of internal managerial and technical expertise.	

extended easily from application strictly internal to NIE to use in building linkages in the external community. Personnel from separate R&D institutions supported by NIE could be selectively collocated and neutral coordinators from NIE could work in the extramural community, as well as within the NIE. In addition, the generally concordant style of personnel relations implicit in the Build-R&D-Resources plan is congruent with the style of coordination in a linked organization.

The matrix organizational structure is less attractive for use with the Build-R&D-Resources plan than the linked structure. The matrix structure cannot be extended as easily to the extramural community since multiple work assignments which are the key coordinative mechanisms in the matrix structure would be inconvenient if done on large scale. The matrix structure is more appropriate when the more directed management styles are used. These styles require ready access to a wide range of internal managerial and technical expertise. The matrix structure provides this access in a direct way through multiple work assignments.

The linear structure could also be used with the Build-R&D-Resources plan, but would not provide the capability for bridging barriers among NIE's internal, organizational units that is provided by the more complex organizational structures, linked and matrix.

Division of Responsibility. Of the two most attractive ways of dividing responsibility, organizing by R&D objective is probably more advantageous for the Build-R&D-Resources plan than organizing by subject area. Dividing responsibility by R&D objectives produces an organization in which the major units are aligned with different categories of R&D performers (fundamental researchers, developers and evaluators, policy researchers, and so on), which allows each unit to maximize its attractiveness to a selected category of R&D performers. As previously mentioned, this is important in the Build-R&D-Resources plan. Dividing by subject areas would mean that each unit would have to support several R&D objectives, which would force each unit to attract R&D performers from several categories. To appeal to these

several categories, compromises would have to be made in the selection of the professional background of unit leadership and in managerial policies, and this would tend to inhibit NIE's ability to compete with other R&D organizations for the most highly qualified R&D talent.

Strategy II Based on the Produce-R&D-Results Plan

Management Styles. If NIE adopted the Build-R&D-Resources plan, use of the more directed management styles would be implied. The policies of identifying technically significant activities internally, and detecting, diagnosing, and decomposing problems both imply strong NIE control over the content of R&D, which requires using the more directed management styles.

R&D Objectives. If NIE adopted the Produce-R&D-Results plan, the problem-solving objective (Objective I) would be emphasized to reinforce the policy chosen for achieving relevance in educational R&D--detecting problems, decomposing problems, and allocating tasks to the R&D community. An emphasis on problem-solving is also consistent with the choice of assuming that enough knowledge is available for the direct solution of practical problems to be undertaken (see Table 8a). Another priority would be policy studies (Objective V) to support problem-solving and the more directed management styles. The objectives of manpower improvement and institutional development (Objectives VI and VII) would probably be deemphasized to coincide with the lack of emphasis in the policies of the Produce-R&D-Results plan on building an infrastructure for educational R&D.

Organizational Structure. Internal coordination of the NIE is essential with the Produce-R&D-Results plan, which suggests that either the linked or matrix organizational structures would be used. Internal coordination is essential because in the more directed management styles used with the Produce-R&D-Results plan, more management functions are performed internally, requiring greater access to managerial and technical expertise. The matrix structure probably provides a more direct method of internal coordination, since access is provided directly through multiple assignments of work responsibility. Therefore, the matrix structure is preferred.

Division of Responsibility. Division of responsibility by R&D objectives probably offers the greatest advantages for the matrix structure for the reason discussed in the section entitled "Selecting an Organizational Structure." Both high differentiation and high integration are desirable in an organization, and division by R&D objective provides higher differentiation than division by subject area. Should a linear structure be used for some reason, dividing responsibility by subject area would be advisable to facilitate coordination among R&D objectives in supporting the problem-solving objective. With this arrangement, problem-solving would be conducted in most or all of the major units of organization.

Strategy III Based on the Support-Disciplined-Change Plan

Management Styles. If NIE adopted the Support-Disciplined-Change plan for organizing the R&D community, using the most directed management styles would be ruled out, for the policy of planning incrementally, "based on results achieved and opportunities encountered," is incompatible with using a highly directed management style.

R&D Objectives. The policies of emphasizing invention as the means of creating significant educational advances and supporting cumulative sequences of experimental interventions imply that practice-oriented R&D (Objective II), not fundamental research or problem-solving, would be emphasized. The Support-Disciplined-Change plan does not imply that any of the other R&D objectives would be strongly emphasized or deemphasized.

Division of Responsibility. Dividing responsibility by R&D objectives is probably best with the Support-Disciplined-Change plan for two reasons. First, the plan implies that large-scale educational interventions would be emphasized as an R&D activity, and these large-scale interventions would tend to cut across the concerns of most conceivable subject-area divisions. If responsibility were divided by R&D objectives, these large-scale projects could be managed by one major unit under the objective to improve policies and practice (Objective II), greatly facilitating coordination.

A second reason for organizing by R&D objectives is that the intervention activity could be segregated into a major unit (or units) of the organization. Another major unit could be dedicated to short-range problem-solving, which would help to divert urgent tasks from the intervention activity and maintain its integrity. Still another major unit could be dedicated to conducting R&D in a more purely scientific way, partly to serve as an evaluative check on the intervention activity and partly to provide an independent source of knowledge and ideas for the intervention activity. Both of these factors are important parts of the Support-Disciplined-Change plan for organizing the R&D community.

Organizational Structure. If dividing responsibility by R&D objectives is adopted, the matrix or linked structures would probably be most useful in that extra capability for coordination is provided, but the Support-Disciplined-Change plan does not especially indicate a need for strong internal coordination of the NIE. If considerations other than those discussed in this report are important to the NIE managers, the linear structure could probably be used without contradicting the Support-Disciplined-Change plan.